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ABSTRACT

These proceedings contain 13 papers: "A Study of the Impact of a Community-Based School to Work Program for High School Youth" (Adler et al.); "A Comparison of Workforce Preparation Policies in the United States and Finland" (Lasonen, Frantz, Jr.); "The Association of Social Position to Restructuring Ability and Symbolic Orientation" (Fritz); "Factors that Influence Women's Choice to Work in the Trades" (Greene, Stitt-Gohdes); "Ideology and Vocational Curriculum: Problems, Politics, and Possibilities" (Gregson); "Usable Knowledge and Problem-Solving Proficiency in Occupational Training" (Krischer); "Use of Thinking Skills in a Selected Work Environment" (Bacchus, Schmidt); "Evolving a Model for Evaluating Tech Prep Implementation" (Ruhland et al.); "On Becoming Reflective Vocational Educators: An Inductive Case Study" (Schell, Black); "Mathematics, Reading, Science, Speaking, and Writing Skills Emphasized in High School Vocational and Academic Classes" (Schmidt); "Educational Environment of Tenth Grade Students: Comparison by Grades, Ethnicity, and GPA [Grade Point Average]" (Newsom-Stewart, Sutphin); "Skills Required of Employees with Only a High School Diploma" (Volk, Peel); and "Integration of Mathematics into Technology Education as Perceived by Technology Education Teachers" (Zhang, Suess). (YLB)

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VOCATIONAL EDUCATION

SPECIAL INTEREST GROUP

PROCEEDINGS

American Educational Research Association

1995 Annual Meeting
San Francisco, CA

April 18-22, 1995

Randy L. Joyner,
SIG Program Chair and Proceedings Editor
East Carolina University

NOTES FROM SIG PROGRAM CHAIR

The 1995 American Education Research Association (AERA) Annual Meeting was held in San Francisco, April 18-22, 1995. The theme for the AERA Conference was grounded in growing acceptance of the need for interdependence among the human service processions (e.g., education, social work, school psychology, public health administration) in order to effectively serve children, adults, and families in America. The 1995 AERA Annual Meeting focused on pioneering research and scholarly efforts associated with interdisciplinary partnerships and the resulting interprofessional collaboration.

The AERA Business Education and Information Systems Research Special Interest Group (SIG) had seven sessions: four paper presentation sessions, two roundtable sessions, and a business meeting. A copy of the SIG program agenda is provided on page v-xi. The 27 papers presented at the conference were selected through a blind, peer refereed process. There were a total of 15 reviewers, with each proposal being read by three reviewers. The 13 papers contained herein are from authors who wished to have their papers published in the Proceedings and also submitted them within the designated time frame and in the appropriate format.

Randy L. Joyner

Randy L. Joyner, Program Chair and Proceedings Editor
Vocational Education SIG
1995 AERA Annual Meeting

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1995 AERA

VOCATIONAL EDUCATION SPECIAL INTEREST GROUP

1995 PROGRAM

SAN FRANCISCO, CALIFORNIA
APRIL 18-22, 1995

4.38 Roundtables
Tuesday, April 18, 1995
2:15 p.m. - 2:55 p.m.
Hilton, Plaza Ballroom, Lobby Level

Tables:

Perkins II Performance Measures and Standards: Lessons Learned From Early Implementers
Brian Stecher, Lawrence Hanser, Bryan Hallmark, ***RAND Corporation;***
Mikala Rahn, Karen Levesque, Gareth Hoachlander, Dave Emanuel, Steve Klein,
MPR Association

Evolving a Model for Evaluating Tech Prep Implementation
Sheila K. Ruhland, Rodney Custer, Bob Stewart, ***University of Missouri-Columbia***

Home Study Environments of Tenth Grade Students: Implications for School Reform of Academic and Vocational Education
Mhora Newsom-Stewart, H. D. Sutphin, ***Cornell University***

An Exploratory Examination of A Framework for Evaluating Vocational Education Programs
Donald D. Peasley, ***Cornell University***
N. L. McCaslin, ***The Ohio State University***

Families' Contribution to Preparation for Work: A Lifespan Perspective
Wendy L. Way, ***University of Wisconsin-Madison***
M. M. Rossman, ***University of Minnesota***

5.02 Roundtables

Tuesday, April 18, 1995
3:05 p.m. - 3:45 p.m.
Hilton, Plaza Ballroom, Lobby Level

Tables:

Job Profiles of Secondary Vocational Education Teachers in The Netherlands
W. G. R. Stoel, J. N. Streumer, ***University of Twente***

The Relationship of Social Position to Restructuring Skill and Symbolic Orientation
Robert L. Fritz, ***University of Georgia***

Integrating of Mathematics into Technology Education as Perceived by Technology Education Teachers
Chi Zhang, ***Michael Reese Hospital and Medical Center;*** *William Suess,* ***Cape Henlope High School***

Developing Leadership in Vocational Education Through On-The-Job Experiences
Judith J. Lambrecht, Charles Hopkins, Jerome Moss, Jr., Eric C. Crane, ***University of Minnesota;*** *Curtis R. Finch, Lex Bruce,* ***Virginia Tech***

Evaluation of Youth Apprenticeship Programs in Georgia
Clifton L. Smith, ***University of Georgia***

Reform of Vocational and Technical Education
Richard L. Lynch, ***University of Georgia***

6.50-Current Trends in Vocational Education:
School-to-Work and Tech Prep
Tuesday, April 18, 1995
4:05 p.m. - 6:05 p.m.
Parc 55, Ruebens Room, 4th Floor

Chair/Discussant:

Robert C. Magee Bacchus, Morehead State University

Participants:

Tech Prep Program Evaluation in the United States: A Panel Discussion
Frank T. Hammons, Florida International University
Marion Asche, Virginia Tech
Debra Bragg, University of Illinois
Thomas Owens, NWREL
Michael Rubin, ETI
Carolyn Dornsife, NCRVE

Study Adolescent Work: A National Perspective
Barbara Schneider, NORC and The University of Chicago
Charles Bidwell, The University of Chicago
James Rosenbau, Northwestern University
Norton Grubb, University of California at Berkley
Betsy Brown Ruzzi, Workforce Skills Program National Center on Education and Work
John Porter, School-to-Work National Alliance for Restructuring Education
Joseph Conaty, US Department of Education

8.12 Business Meeting
Tuesday, April 18, 1995
6:15 p.m. - 7:45 p.m.
Hilton Union Square 11, 4th Floor

President:

Larry Pucel, University of Minnesota

Program Chair:

Randy L. Joyner, East Carolina University

Secretary:

Vivian Arnold, East Carolina University

Invited Speaker:

An Outside on the Inside--A Candid View of the United States Department of Education
Karen Kuhla, University of Virginia

Paper Presenters:

A School District Response to Tech Prep: A Study for Academic and Vocational Education Integration and Community Partnerships
Michael J. Herrick, University of Wisconsin--Eau Claire

Los Angeles Area Business/Education Partnership: A Study of the Impact of a Community Based School-to-Work Program on High-Risk Youth
Laurel Adler, John Cragin, E. San Gabriel Valley Regional Occupational Program; Rita Hensley, University of California-Riverside; Chris Almeida, California Department of Education

14.49 Career Development Through Vocational Education

Wednesday, April 19, 1995
10:35 a.m. - 12:05 p.m
Nikko, White Pearl II Room, 2nd Floor

Chair/Discussant:

Shirley W. Hall, Southern Illinois University at Carbondale, Travis Air Force Base, California

Participants:

Evaluating State and Local Initiatives in Planning and Implementing School-to-Work Transition Programs
Floyd L. McKinney, Western Michigan University

Factors Influencing Women's Choices to Work in Skilled Trades
Wanda L. Stitt-Ghodes, Cherry Greene, University of Georgia

Vocational Education and Values Regarding Labor
Wiel Veugelers, University of Amsterdam

Voices of Diversity in Emerging Vocationalism: Student Perspectives on School Climate
Victor M. Hernandez-Gantes, L. A. Jones, J. Jones, T. Holub, D. Sanchez, University of Wisconsin-Madison

16.50 A New Vision for Vocational Education
Wednesday, April 19, 1995
12:25 p.m. - 1:55 p.m.
Nikko, White Pearl II Room, 2nd Floor

Chair/Discussant:

Randy L. Joyner, East Carolina University

Participants:

Research-Based Case Studies: Creating Resources to Assist Teachers in the Integration of Academic and Vocational Education
Curtis R. Finch, B. June Schmidt, Susan L. Faulkner, Virginia Tech; Jerry Kandies, Delta State University

Mathematics, Reading, Science, Speaking, and Writing Skills Emphasized in High School Vocational and Academic Classes
B. June Schmidt, Virginia Tech

On Becoming Reflective Vocational Educators: A Case Study of a Professor and His Co-Learners
John W. Schell, Rhonda Black Stout, University of Georgia

Ideology and Vocational Curriculum: Problems, Politics, and Possibilities
James A. Gregson, Oklahoma State University

18.56 Workplace Skills Needed
With A High School Diploma
Wednesday, April 19, 1995
2:15-3:45 p.m
Nikko, White Pearl II, 2nd Floor

Chair/Discussant:

Phyllis Bunn, Virginia Tech

Participants:

A Comparison of Contemporary Approaches to Workforce Preparation of Youth in the United States and Finland
*Nevin R. Frantz, **Virginia Tech**; Johanna Lasonen, **University of Jyvaskyla***

Skills Required of Employees With Only A High School Diploma
*Ken Volk, Henry Peele, **East Carolina University***

Use of Thinking Skills in a Selected Work Environment
Robert C. Magee Bacchus, ***Morehead State University***
*B. June Schmidt, **Virginia Tech***

Usable Knowledge and Problem-Solving Proficiency in Occupational Training
*Michael Krischer, **Portage, MI***

A Study of the Impact of A Community Based School to Work Program for High Risk Youth

Laurel Adler, John Cragin, Peter Searls, Rita Hemsley & James Dick
The Los Angeles Area Business/ Education Partnership

Background: The New Economy

It has been widely documented that the income disparity between the rich and the rest of American society has been steadily widening for more than two decades. As Walter Russel Meade (Los Angeles Times, 1994) points out, "rising (Gross Domestic Product) no longer means a higher standard of living for the majority of American households." A broad range of policies have been proposed to reverse the trend. However, what has been less apparent is the strong parallel between the economy of the 1990s and that of the 1 890S.

A century ago the average American family was still struggling to cope with the economic dislocations engendered by the Civil War and the Panic of 1873, which had combined to reverse nearly 30 years of growing equality of wealth and a rise of a middle class. Income distribution had become radically skewed. Immigrants crowded our major cities, competing for work with hordes of American born farm laborers made jobless by advances in agricultural technology. In a monumental example of short-sightedness, the director of the U. S . Patent Office resigned because "everything useful or necessary has already been invented." Newspapers printed hundreds of articles warning of the impending collapse of American society and perhaps of all civilization.

To be sure, the oncoming scientific revolution was already in evidence. But it was a future many feared rather than welcomed, apprehensive that only a wealthy elite would benefit from the new technology while the masses would be reduced to poverty. Of course, as we all know, the ensuing decades brought enormous riches and prosperity and the creation of undreamed of employment opportunities. In the 1890s no one foresaw a society needing automobile assemblers, machinists, flight attendants, X-ray technicians, punch press operators, airframe mechanics, dry-wallers or a host of other occupations which did not exist then but which are in demand now.

Today, however, the manufacturing jobs which brought prosperity to so many are disappearing, going the way of nineteenth-century farm labor.

Secretary of Labor Robert Reich (December, 1994) describing how job skills are affecting the social structure of the United States, explains that the old middle class which has dominated the economic scene in America since World War II has splintered into an underclass, an overclass and an "anxious class". The educational backgrounds of people in the former middle class may have differed, but there was an underlying unity. Now the middle class has developed into anxious group of people who hold jobs but are justifiably uneasy about their own standing in the economy and fearful for their children's futures. The remainder have fallen into either an underclass that is increasingly isolated from the core economy or an overclass that is well-positioned to move up, capitalizing on market place changes. The fundamental fault line according to Reich between these groups is based on education and skills.

Drucker (November, 1994) describes the current trend as moving toward what he calls the "knowledge based society". According to Drucker, in this economic order, knowledge, not labor or raw material or capital is the key resource. Drucker notes that the knowledge workers require a good deal of formal education and the ability to acquire and to apply theoretical and analytical knowledge. They must have a different approach to work and a different mind-set. Above all, they must develop a habit of continuous learning. Displaced workers cannot simply move into knowledge work or services the way displaced farmers moved into industrial work. At the very least they have to change their basic attitudes, values, and beliefs (Drucker, 1994). Farmers were not "pushed off" or "displaced". They went into industrial employment as fast as they could. Industrial jobs required no skills they did not already possess and no additional knowledge. But as Drucker acknowledges (1995), in the knowledge society, more and more skills will be needed.

Changing the mind-set of the American public from an industrial-based economy in which low skilled workers could earn high pay, to an economy in which the acquisition of knowledge is the key, is the social challenge of the knowledge society. However, as Marshall and Tucker note in Thinking for a Living (1992), for most of this century, American enterprise has been organized on the principle that most of us do not need to know much to do the work that has to be done. The United States economy has been structured to operate largely on the premise that, for the country to be successful, only a few need to know or be able to do very much. The American workforce has been split into two disparate parts (Department of Labor, 1992). A small minority, empowered by education, is highly skilled and highly paid. Others have been isolated and relegated to low pay for work requiring minimal skills.

Students now need to develop both broader and deeper skills in order to meet new competitive standards and to complement flexible organizational structures and technology (Carnevale, 1993). American workers need competencies that go far beyond the traditionally recognized "Big Three" of reading, writing, and arithmetic (Foucar-Szocki, 1992). On-the job diverse tasks have been combined in new ways and even entry-level workers have been given new responsibilities. Employees today need to know how to communicate effectively and how to think creatively and independently. They need to be problem-solvers. They must be adept at negotiating and at working as part of a team. They must know how to lead, how to motivate, how to improve continually. Fortune Magazine (June, 1994) describes the new kind of employee as one who is empathetic, flexible, inventive, and able to work with minimal levels of supervision. The competitive workplace of today, regardless of the product or service, is a high skill environment designed around technology and people who work as part of a much larger whole.

Education and the Economy

Education in America has been characterized by a duality of its own. According to Reich (1992), the vast majority of America's students are being subjected to a standardized education designed for a no longer existing standardized economy. By this Reich explains that America's educational system at mid-century mirrored the national economy of high-volume production with an assembly line curriculum. Reich, like Marshall and Tucker, observes that although the economy is changing dramatically, the form and function of the American education system has remained roughly the same (Reich, 1992) . This system, while continuing to serve the needs of the university bound student in a somewhat acceptable manner, has virtually ignored the more than 50% of students who do not pursue a traditional four year college education, even though these students face the most daunting obstacles in attempting to find well-paying jobs. The mismatch between the focus of K-12 schools and serious, coherent economic preparation of students is deeply rooted in the dualism between culture and vocation, head and hand, abstract and concrete, theoretical and applied (Berryman, 1992).

Stern (1992) notes that since the 1917 Smith-Hughes Act, vocational education has been defined as preparation for occupations not ordinarily requiring a bachelor's degree or advanced degree. Accordingly, students aspiring to the more highly paid and prestigious jobs for which college degrees are required have avoided vocational education. The unintended result has been to institutionalize a superficial dichotomy between academics and vocational education. In the schools, this dualism manifests itself in decontextualized academics and academically debased vocational education (Berryman, 1992). This duality is currently locking individuals out of the economic mainstream, either precluding their entry into or making them marginal to the labor market.

Academic and Vocational Integration

The integration of vocational and academic learning is intended to eliminate the dichotomy that exists between vocational and academic education. Integral to the School-to-Work Opportunities Act of 1994, the core of this concept is to organize the best curricular and pedagogical practices of academic and vocational education into a single, "integrated" experience. The goal of an integrated curriculum is to ensure that each student learns both theory and application in specific career preparation, learns transferable academic and vocational skills that are needed in the workplace, and demonstrates competence in those skills that assure successful transition from high school to postsecondary education. According to the Rand Corporation (1993), this approach is designed to rectify the following perceived problems: 1) Poor basic and generic work-related skills; 2) Inability to apply knowledge drawn from theory to solve workplace problems; 3) Lack of engagement on the part of students who have dropped out of school; 4) Poor school transition in which students graduate from high school unprepared for the transition to college or the work world; and, 5) Negative effects of tracking.

Norman Grubb of the National Center for Research in Vocational Education (NCRVE) (1993), has identified three types of academic vocational integration: 1) **Academic and Vocational Education** in which there is horizontal (coordinating courses) and vertical (creating sequences of courses) alignment of academic and vocational curriculum; 2) **Secondary and Postsecondary Education** where course content is articulated to provide 2+2 and 2+2+2 course sequencing; and, 3) **School-to-Work** in which curricula outcomes match the needs of high-skills, technological workplaces. Businesses are major partners in curriculum planning, program evaluation, and providing worksite instruction which allow the student to apply both academic and technical skills in a real life work setting.

The Los Angeles Area Business/Education Partnership has developed an academic/vocational integration reform model that has as its major goals the reform of current curriculum and pedagogy along the three types of integration outlined above by Grubb. The model for this reform program is reflected in the theories of Berryman (1992) and Gardner (1991) and their work in cognitive science. At the heart of cognitive science is the presumption that intelligence and expertise are built out of interaction with the environment, not in isolation from it (Berryman, 1992). It thus challenges our traditional, and for the most part superficial distinctions between head and hand, academic and vocational education, knowing and doing, abstract and applied, education and training, and school-based and work-based learning.

Gardner (1991), notes that ultimately, any form of learning requires performance. For this performance to have meaning, it must be offered in context, what Gardner calls contextual learning. Gardner advocates a learning structure built along the same lines as an apprenticeship, what Berryman calls cognitive apprenticeships. **Cognitive apprenticeship** according to Berryman is a paradigm of instruction for all students, it is not a clever renaming of vocational education. Cognitive apprenticeships modify traditional apprenticeship to include symbolically-based and therefore less observable activities, such as reading, writing, and mathematics. The focus of cognitive apprenticeship is on learning through guided experience, emphasizing cognitive skills and processes, in addition to the physical ones that characterize traditional apprenticeship. Thurow (1992), cautions that work-based apprenticeships alone tend to produce workers with very narrow skills who cannot absorb new technologies. Berryman (1992), notes that work-based apprenticeships and school based cognitive apprenticeships taken individually have pluses and minuses. She asserts however, that a mixed strategy of school based cognitive apprenticeships and work-based apprenticeships (paid or unpaid) may offer the optimal opportunity to integrate vocational and academic education. The curriculum and instructional strategies of the Los Angeles Area Business/Education Partnership combine work-based apprenticeships and school-based cognitive apprenticeships to provide optimal learning experience for students. This Program model focuses on instruction that is project oriented and is integrated into academic/vocational clusters rather than being divided into isolated courses. Business/education partnerships provide an avenue where project oriented learning can optimally occur within integrated academic/vocational clusters.

Model Project: TARGET COMMUNITY

Target students of this demonstration project are students from participating high schools in Eastern Los Angeles County. The specific area has been identified by Rebuild LA (RLA), the community group formed to help Los Angeles recover from the riots, as "a neglected area". Los Angeles has been described as "an international metaphor for the urban challenge" (Tuttle, 1993). The target community of this study is a microcosm of the larger Los Angeles community and is predominantly made up of ethnic minorities with Hispanics being the largest ethnic group at over 65% of the population. United Way of Los Angeles conducted a survey of the primary target area and found that it has the highest growth rate and population density as well as the largest household size and youngest population in Eastern Los Angeles County. The unemployment rate in the area is among the highest in the eastern county and has the lowest per capita income and the highest percent of people living in poverty. Nearly one-fourth of all children aged 0-17 live in poverty. The dropout rate at some area high schools is as high as 55%. Clearly business as usual does not suffice for this population. There is an acute need for reform that addresses student, academic, and vocational training needs while providing necessary support services.

The program under review has focused on these major goals:

1. To provide students the instructional and support services beyond those traditionally offered in a high school setting, which are needed to help them graduate from high school.
2. To provide students the skills and attitudes needed for successful

competitive entry into the workforce.

3. To articulate the program curriculum with college and university instruction, therefore providing students the motivation as well as the opportunity to pursue higher education.
4. To utilize business and industry for major portions of student instruction.
5. To provide a comprehensive curriculum, reviewed regularly by business and industry, that emphasizes the integration and acquisition of both academic and career related skills.
6. To produce students with marketable job skills, including entrepreneurial and networking skills, as well as a clear understanding of the work ethic.
7. To produce competent, aggressive leaders capable of advanced career positions.

The model operates under the philosophy that true educational reform must be locally initiated and that rigid activities that might work in one setting may not be appropriate in another. Therefore the model emphasizes the development of the process for producing an integrated program that taps into local resources along with actual curricula that can be replicated in diverse settings. A major component of the project is a series. of integrated curricula which utilize projects, games, and worksite learning. A major goal of the project is to demonstrate that the specific strategies that the model utilizes has a significant positive effect on high-risk youth in terms of high school graduation, academic achievement, progress to postsecondary education and employment.

The model program achieves these goals by utilizing several **key components.** They are:

1. Clustered instruction that combines subject matter such as math/physics/computer assisted drafting into a unified program area and which provides instruction within the context of specific career pathways.
2. Adaptive curriculum that emphasizes cognitive apprenticeships and experiential learning.
3. A combination of instructional approaches including classroom instruction, worksite apprenticeships, community learning, student internships, cooperative learning groups, peer tutoring, community mentors, job shadowing and individualized computer instruction. Students access information and create projects with various technologies.
4. Cooperative educational programs with business and industry that enable students to receive a portion of their instruction in the community. Industry-based worksite apprenticeships (paid and unpaid) allow the student to experience, early on, the application of academic skills to careers. Worksite apprenticeships also afford students access to technology routinely used in the workplace. Learning technology is viewed by business partners as a community investment.
5. Articulation of Curriculum developed by the project with appropriate courses at local community colleges and universities. Prior to the completion of the twelfth grade, project students are permitted to take the academic assessment tests required by the participating colleges, and if passed at the required level, the college will waive the assessment requirement when the student enters the college.
6. Cooperative liaisons with local business and industry, colleges, universities, and high schools that link the high school student simultaneously with business, community and post-secondary institutions. This allows accessibility to both real world experiences and for continuation

into post-secondary education for students who previously may not have realized their potential.

7. Early identification and accessible ongoing monitoring and support services which monitor student progress, identify potential problems, and provide services to assist students overcome barriers to school completion. Business volunteers, college and high school students, and senior volunteers acting as tutors, mentors, job coaches and peer advisors serve as role models that provide confidence and assurance to participants. Other vital support services include child care for teen mothers and transportation to worksite learning.
8. Parental involvement which includes the parent in the assessment, goal setting, monitoring, support and follow-up process.
9. Cooperative liaison with local community service agencies which provide a wide variety of support services necessary to meet the diverse needs of students and their families possess.
10. Guidance and counseling that includes the use of general and career counselors and technicians as well as teachers, mentors, and support staff to assess and counsel students for career decision-making and career pathway preparation. The overall counseling and guidance services are linked to "early identification and accessible support services" to meet the additional needs of at-risk students experiencing academic, vocational, and/or personal barriers to success.

Training Process

Student Enrollment - The project itself operates on an open-entry, open-exit basis. Individual student goals are set and may include: (1) intense remediation in basic subject areas; (2) pre-vocational and vocational training; (3) assignment to a mentor and/or tutor; (4) counseling and guidance including home-based guidance; (5) assignment to a cluster group (school-within-a-school) and cooperative learning groups; (6) worksite learning; and (7) summer employment opportunities.

Assessment - Prior to and during enrollment, students are assessed including an in-depth academic and vocational assessment. The results of the student's assessment are be included in the Personal Academic and Career Plan (PACP) provided for each student.

Individualized Learning Plan - An Individualized Plan is developed for each student. Included in this plan are the specific academic skills, and job related competencies each student needs to achieve for proficiency in his or her training plan. Specific support and follow-up services needed to provide for transition into employment are identified and provided.

Referral and Placement into Appropriate Learning Program(s) Using Partners - Program placement is based on assessment results and student goals. Business volunteers and college students, provide individualized, competency-based tutorial instruction. Tutors also work with small groups in cooperative learning teams. Occupational skills training occurs both in the classroom and at business partners, worksites. Worksite and classroom instruction is coordinated and sequenced in a manner which assures each complements the other. Business and industry partners participate in subject matter advisory meetings to assure this instruction is coordinated and relevant to current market standards. Various instructional strategies are implemented to enhance career awareness, employability skills and/or basic academic skills, and include individualized instruction, direct group instruction, and cooperative learning groups.

Support Services - Specific support services are provided to students by a wide variety of community and business partners and are initially identified at the time the student enrolls. At-risk students have a range of special needs that often go unfulfilled. As a result, many often move through the system, fall further behind and dropout. The schools and colleges involved in this pilot project have formed partnerships with community based organizations, social service agencies, State of California service providers and businesses to help meet these special needs. Community linkages which provide necessary social support assistance for students and their families include Los Angeles County Mental Health, Los Angeles County Department of Health Services, the California Employment Development Department, the California State Department of Rehabilitation, city parks and recreation and community service organizations make up a part of this social services network. Child care is provided as needed as is transportation. Parenting skills are taught to teen parents.

Tech-Prep Articulation Agreements - 2+2 and 2+2+2 Tech-Prep articulation agreements are a vital aspect of the model project. These articulation agreements allow the student to apply course work completed at the secondary level to program requirements at the community college. In the case of a 2+2+2 tech-prep articulation agreement, community college course work can be applied at the university level. Currently over two dozen such agreements exist.

Business Partnerships - There are currently over 300 partnership agreements between business and the Program. Project instructors develop new partnerships on an on-going basis. Business and industry provide worksite instruction, mentoring, job shadowing, and job placement opportunities for students. In addition, they provide up-to-date labor market information and assist in the development and modification of curriculum. The business component of the partnership includes on-the job training and placement for students. Job placement is a key aspect of this model program for students nearing program completion. Viable employment options which provide for movement up the career ladder are an integral aspect of the project.

In addition to its affiliations with business and industry already mentioned, the project has as its partners a wide variety of state, Federal, and local resources which allow it to offer a large number of supportive services to participants at all stages of their training. These resources include: National Council on Aging which provides tutors and mentors for high risk students; JTPA, which provides job development and job placement; Department of Rehabilitation which provides needed support services for students; the California Employment Development Department which allows access to daily up-to-date job placement information and services; and, local Chamber of Commerce's which provide job shadowing and role modeling by having business and industry leaders volunteer to be guest speakers and mentors. By utilizing a wide variety of community and other resources, the model is a cost-effective one that offers the prospect of being replicated in whole or in part.

Program Evaluation

The evaluation component is a strong part of the total design of the project. The University of California-Riverside, educational research wing of the California Education Research cooperative (CERC) performs the role of Director of Evaluation of all project objectives and supervises a multi-year student follow-up. The following section describes the follow-up study of project students enrolled in the Business Marketing career cluster of the program. Students involved in this study were in the program between 1987 and 1992. Follow-up research on students from at least four other career cluster areas will be available in August, 1995.

Evidence of Program Effectiveness

Claim Statements

The claims for this program are that, relative to other general track high school students, participants in the program have a higher probability of:

- graduating from high school,
- continuing into post-secondary education,
- securing employment, and
- on-the job upward mobility

Research Methodology for ClaimsDesign

Students in the treatment group were identified as those who had participated in the Apparel Marketing program from 1986 through 1991 during their last two years of high school. Program participants were given a structured interview after they had been out of high school one to four years. Only those students who completed the follow-up interview (70% of program participants were contacted) and had sophomore GPA data were considered as the treatment group in these analyses.

A matched comparison group was retroactively sampled from students who attended the same high schools during the same years as the treatment group. Students in the comparison sample were initially matched on the basis of: 1) not having enrolled in any ROP, vocational, special education, or advanced placement courses; and, 2) began high school during the same years as the treatment group (1983-87). 672 of the initially identified comparison group were successfully contacted and interviewed with the same instrument as the treatment group. This represented a much lower contact rate (40%), and most of those who could not be contacted had reportedly relocated since high school. It was unclear from available data whether the apparently greater mobility within the control group was a condition preexisting the study or related to a failure to receive job training.

This initial comparison group was over sampled which thus allowed for more stringent matching procedures to be pursued. In this effort, the initial comparison group was stratified by sophomore GPA quartiles, ethnicity (Hispanic & non-Hispanic) and gender, thus producing a 4 x 2 x 2 sampling matrix. (Random sampling from each comparison group strata to match the distributions in the treatment group.) Consequently, the disproportionate gender distribution in both the treatment and comparison groups is due to more females than males enrolling in the Apparel Marketing course. This disproportion could indicate a gender effect *within* both the treatment and control groups and when interpreting and generalizing the findings the fact that the sample consisted primarily of females should be considered. However, differences *between* the treatment and comparison groups are the focus of this analysis and so balancing the two groups on gender, its effect is controlled.

The initial comparison group consisted of 67% Hispanic students and a 50% Hispanic representation was present in the treatment group. After selecting only those students in the treatment group who had sophomore GPA, it consisted of 48% Hispanic. The stratified, random matching procedures of discussed earlier created equally proportionate samples, with 48% Hispanics in both the treatment and control groups.

Sample

A total of 550 students were included in the final sample. As a consequence of the post hoc matching procedures, each group had 275 students, matched on ethnicity, gender and quartile of sophomore GPA. As a result of the stratified random matching procedures, no variation occurred between the two samples on these three variables. Almost half of the sample was Hispanic (48%) and 85% of the students were female. Sophomore GPA was 2.04, slightly above the average from that of the participating districts (1.98).

Instruments and Procedures.

The instrument used in the structured, telephone interview was one initially developed by the ROP and the University of California, Riverside for collecting information on program completers and leavers, as well as determining post program job status for state-required annual reports. These follow-up procedures have been followed by the ESGVROP for several years, providing for ample field testing and maximizing return-rates. ESGVROP modified the standard, state form to include more detailed questions about high school graduation, pursuit of higher education/training, and work status. A copy of the one-page list of questions asked in the phone interview is included in Appendix A.

At the time of contact the treatment group had been out of high school for an average of 2.45 years. The age of the treatment group was younger than the comparison at the time of graduation (T =17.65, C = 18.15) but because the length of time between target graduation date and follow-up was longer for the treatment group, they were older at the time of fillip (T = 20.59, C = 19.38). The comparison group had only been out of school for 1.16 years at the time of follow-up. The serious nature, and implications, of these discrepancies are discussed later in this paper.

Data Collection

Student grades for both the treatment and control groups were provided by high school counseling offices. Ethnic classification was reduced to Hispanic or non-Hispanic because of the limited nature of the data on the comparison group. Even this simple dichotomy was derived not from established ethnic codes at the district level, but rather by student surname. Gender, however, was clearly indicated with district data.

Follow-up data were gathered via the phone interview described previously in the instrument section. All of the phone interviews for both the treatment and control groups were conducted between October 1991 and March 1992. Two bilingual staff members at the ROP were selected to conduct the interviews based on their fluency in both English and Spanish, their familiarity with the programs offered by the ROP, and their skills in telephone communication. In the majority of cases, the information was provided directly by the individual students identified for the sample. Occasionally, however, the information was relayed by a parent or other close family member of the student. Interviewers believed the responses were candid and accurate, attributing this partially to the non-threatening introduction given at the beginning of the interview and partially to the inherent "care" factor in any type of follow-up interview. Follow-up with businesses to validate information was also done.

The number of years the student groups were out of school when the follow-up interview was made should be considered since the longer students are out of high school the more likely they are to attend some college and get into good jobs.

Data Analysis

Descriptive statistics were generated using SPSS/PC 6.0 statistical software. Because of the careful, post hoc sampling (i.e., matching on ethnicity, gender and GPA), the confounds of ethnicity, gender and sophomore GPAs within the two groups were controlled. As such, the claims made with these data are substantiated with relevant contingency tables and the resulting chi-square statistic of differences.

Description of Results for Each Claim

1. Treatment More Likely to Graduate from High School.

A significantly larger proportion of treatment students graduated from high school than did students in the control group $X^2 = 54.30, p < .0001$). Of the students with available data, over 90% percent of them graduated from high school. This figure differed drastically from the strikingly low graduation rate of 65% for the students not receiving the treatment. The average graduation rate among the participating districts is estimated to be about 70%, indicating a cohort dropout rate of about 30%.

For both groups the sophomore GPA (baseline) represented a "C" grade average. The difference between this baseline and the GPA at time of exit from high school was significantly improved from 2.04 to 2.21 (F_{274} df = 8.68, $p < .001$)) only for those students in the treatment group.

2. Treatment More Likely to Pursue Higher Education.

A higher rate of 65% of college attendance was claimed for the treatment group. Less than 45% of the control group attended college. These figures support the second claim that the treatment group would pursue higher education more frequently than the control group ($X^2 = 28.21$, $p < .0001$).

A notable difference was evident between the groups on the types of further education pursued. As depicted graphically, the largest group of college-attending students in both groups are attending community colleges. Almost twice as large a proportion of college-going students in the comparison group are found at a 4-year college. A similar disproportion is found between the two groups attending Trade/Tech schools: twice as many college-attending students in the treatment group attended a Trade/ Tech school as did in the control group.

3. Treatment More Likely to be Employed.

A graphic representation of employment status showed the most marked contrast between the treatment and control groups of any of the comparisons made. 87% of the individuals in the treatment group were full-time employed as compared to only 64% their counterparts in the comparison group ($X^2 = 61.86, p < 0001$)

4. Treatment More Likely to have Upwardly Mobile Jobs.

The fourth claim supported with data represents the type of job secured by the student. Upwardly mobile jobs were defined as those jobs where there was some management responsibility, (i.e., supervisor of one or more persons) and where there had been a pay increase within the past year. These data on employment mobility seem to offer the strongest evidence of the advantages of the treatment program for youth who are recently out of high school. That almost twice the percentage of students in the treatment group who had jobs were in upwardly mobile jobs is quite strong evidence of the effectiveness of the program ($X^2 = 5.60, p < .05$).

Summary of Supplementary Evidence for Program Success

Quantitative analysis of the outcome data provides strong support for the four claims. Other, more qualitative descriptions can also provide valuable evidence of program success. The anecdotal data that help to explain the relationship of program components to outcomes are provided in this section.

Increased student graduation rates and a concomitant reduction of dropouts may be related to the ability of the program to engage students in learning and preparation for a career. Evidence of the level of this engagement is shown through student involvement in clubs and statewide competitions. The higher rates of college attendance may be influenced by affiliations between the ROP program and area colleges and trade/technical schools. The extent of these relationships is evidenced by a listing of those schools of higher learning (see appendix B) with which the program has partnership affiliations and curriculum articulation agreements.

Placement in upwardly mobile jobs related to training seems to be improved when a training program works closely with business and industry. With over thirty participating area businesses affiliated with the program, support is given to the positive link between the business/school partnership modeled by this ROP program.

Connections with Business and Industry.

A characteristic of the program that contributes to the success of students in competing for quality jobs is its strong connection with business and industry. Strong ties with business are visible through the nearly 50 businesses that provide on-site training of students. Further, representatives of business validate course competencies as well as the college and university articulation process. Business representatives serve as guest lecturers in the classroom and as professional role models and mentors.

Engagement of Students through Career-Related Activities.

One of the outstanding characteristics of the program contributing to the high rates of graduation among the participants is the extent to which it engages students in learning through incorporating into the curriculum what is normally seen as extracurricular leadership clubs and activities. For example, all students are automatically considered members of a national club of marketing students. As such, they participate in local, state and national competitions which provide them the opportunity to network with students from around the nation. A great deal of enthusiasm is generated through the participation in these conferences and competitions. Students who have won in the competitions have been able to establish valuable contacts and career networks as a result.

Incentives to Pursue Higher Education.

A key component of the program that may contribute to the high rates of continued education is the partnerships with institutions of higher education. Through these partnerships, various curriculum articulation agreements have been forged, providing students college credit for courses taken at the high school level through the ROP. In addition to a jump-start on college, students are given tours of the programs that represent a continuation of their study in the marketing and merchandising field.

Program Recognition and Awards.

If public recognition is evidence of program viability, then this program certainly meets a high standard. The program has received recognition on the national, state and local levels for its outstanding quality. A partial list of awards and recognitions is provided as evidence of overall program quality. Appendix C represents the major recognitions and awards that the model program has achieved in the four years since its inception.

Interpretation and Discussion of Results

This study does provide a valuable look at the differences between a general track high school program and one that is supplemented with a focused career training component. The following sections explore the relationships between treatment and effect that warrant further analysis and the possible rival hypotheses.

Relationship Between Effect and Treatment

To explore alternative explanations of treatment effect on graduation, one would have to assess student motives for entry and exit from the program, the extent to which students felt the program influenced their decision to stay and complete high school instead of dropping out, and the extent to which support services contributed to program and high school completion.

The program feature appearing to be linked to increased rates of pursuing higher education was the articulation of program curriculum with institutions of higher education. Program administrators report that as students in the program earn college credit for their work at the ROP while still in high school, their own level of self-confidence in their ability to succeed in college seems to increase markedly. In addition, as students are exposed to specific career options with greater earning potential in the field, they seem to more frequently choose to continue their education as the best route to self-improvement. To confirm these projected relationships between program components and effects on student pursuit of higher education one would have to follow-up on levels of student self-confidence, improvement of grades and study skills, and students' reasons for continuing their studies.

The extreme differences between the treatment and control groups on full-time employment indicates a powerful treatment effect. Over ninety percent of the treatment group was full-time employed, while only about forty percent of the control group held full-time jobs. The program features that could contribute to higher employment rates for the treatment group include tutoring and mentoring, training in specific job skills, on-the job training and coaching, training in job readiness and job finding skills, and free placement services. Other program characteristics that may contribute to high placement and employment rates include a relevant and up-to-date curriculum, close connections with business and can be effectively implemented. For a program to be able to claim that high school students who choose to participate will have half-again as much chance of continuing into higher education, and more than twice the chance of being employed within the first few years out of high school, is evidence enough that the program has some advantage over the general track high school program. When this is topped with the claim that program participants have four times the chance of being promoted into management level positions within the first two-to-four years out of high school, then it becomes clear that this program can bring about some positive outcomes.

The educational significance of this program's success is that career prepa-ration, when properly planned and delivered within the context of the existing business community can have a profound impact. Programs with the characteristics contained this model have the potential of revitalizing secondary career preparation. A healthy combination of academic and practical skills in the curriculum can attract and keep students interested in learning. A school climate that emphasis the value of individual students' strengths and interests can heal self-esteems bruised through social ills. The integration of services from a variety of agencies can smooth the transition from adolescence to adulthood. A shared responsibility with business and industry for training can insure the successful transition from school to productive work life. A strong network with institutions of higher learning can open the chance of a college education to underprivileged youth. Programs of this nature truly demonstrate what "educational opportunity" is all about.

Comparison of Results to Results from Other Programs

The United States Department of Education (Goals 2000, 1994) indicates that no studies currently exist for a comparison of this school-to-work career preparation program to other school-to-work preparation programs. This is not surprising since school-to-work programs are a recent innovation. However, such programs are going to proliferate, in no small measure due to the School-to-Work Opportunities Act. This project is one of the first to be funded under this legislation. As a result, it should be among the models, both in programmatic and research design, for future projects.

Perhaps the closest parallel to the ROP project is the Richmond County Tech Prep Program in North Carolina. Like the ROP project, Richmond County upgraded computational and communications skills requirements for participating students. Also, both agencies serve communities which are lower in socio-economic measures than the averages for their respective states. The ESGVROP study is longitudinal, tracking both treatment and control groups for seven years, while the Richmond County study pulled sample control groups from two different cohorts. Each design has its advantages and disadvantages. However, both studies showed that students who took part in the treatment programs performed at a significantly higher level on the specified measures than students in the control groups. Both studies evidenced a reduction in the dropout rate among program participants.

However, the Richmond County program targets students who would benefit from community college programs. The ESGVROP program is aimed at a broader segment of the student population--virtually all secondary students, in fact--and seeks to improve opportunities to enter employment directly, as well as to obtain further training. The ESGVROP project does not "enrich" vocational classes. Rather, students in academic classes are made aware of the requirements in the workplace for the skills they are learning.

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Appendix A
Follow-up Phone Interview Questions

Introduction

Introduce yourself in the following manner:

Hello, my name is   , I am performing a follow-up study of students who have attended high school. I would like to ask you a couple of questions about what you've been doing since you left high school. Your name will not be used or revealed. We're only interested in how all students who attended high school are doing now.

Questions

1. Did you finish high school at high school and receive your diploma?
2. (if not) Did you receive a diploma from another high school?
3. (if neither of the above) Did you take and pass the GED?
4. Are you working now?
5. (if yes) How much? (full-time or part-time) What is your job title or position?
6. (if not working) Have you ever worked since high school? Are you presently seeking employment?
7. (if working or has worked) Was or is your job related to the training you had while in high school?
8. Are you now going to school? If so, what and where are you studying?
9. (if not in school) Have you taken any schooling since high school? If so, where and what did you study?

Notes

If the student is not at the address you call, ask if you can have the telephone number of where they can be located. You do not need to speak to the student directly. If there is someone else willing to give you the information, they may be used. Grandmothers are especially helpful.

Appendix B

Educational Partners with Articulation Agreements

California State University, Los Angeles: CSULA has always had an unusually large proportion (over 55%) of minority students and is recognized nationally as a leader in educational services to minority and urban students. The Federal Government has designated CSULA as a recognized Minority Institution and the student body represents the greatest cultural richness and broadest ethnic diversity of any campus in the nation. Located in East Los Angeles, it has a student body of 21, 596. In 1990, the largest number of Bachelor degrees awarded were in the areas of Business Administration and Engineering. CSULA offers a wide range of support services for special needs students, such as low-income, disabled, and academically disadvantaged. Both its diverse student body and its central location in Los Angeles make it an ideal partner in the Los Angeles Trade Technical Education Consortium.

Los Angeles Trade Technical College: Located in the center of downtown Los Angeles, LATTC brings to the consortium strong bonds with the Los Angeles business community as well as a reputation as one of the finest community colleges in California. It currently has a student enrollment of 11,600, 89.4% of which are minority. LATTC is known for its strong contacts with and participation of business and industry. Its classrooms are designed and operated as if they were actual businesses. Equipment is state-of-the-art.

Los Angeles Southwest College: Founded in 1967, Los Angeles Southwest College is located in South Central Los Angeles. It currently has an enrollment of 7,000, 89% of which are minority. In addition to strong academic and vocational training programs, the college has a wide variety of student support services such as ESL assessment, tutorial assistance, peer counseling, employment transition and child care.

Mount San Antonio College: Located in the eastern section of Los Angeles County, Mount San Antonio College (MSAC) is the largest community college campus in California with an enrollment of nearly 30,000. MSAC was an early leader in the state in advocating tech prep agreement, and operated one of the first California pilot demonstration projects in 2+2 articulation.

Appendix C

- Awarded as a United States Department of Education Outstanding Vocational/Technical Program
- Selected by the United States Department of Labor as a SCANS exemplary program
- Selected by the California State Department of Education as a model program in several key area including assessment, training and job placement
- First vocational program in California to be certified for excellence by the California State Department of Education
- Chosen by the California State Department of Education as Outstanding Vocational/ Technical Program in 1990
- Selected by the California Chancellor's Office of Community Colleges as a model site for 2+2+2 secondary-to-college articulation and transferable credit

A Comparison of Workforce Preparation Policies in the United States and Finland

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The formation of global economic linkages between nations has created changes in the relationships between countries and among the people who reside within their boundaries. In North America, the recent approval of the North American Free Trade Agreement is creating a new geographic marketplace that will rival the emerging European Union of Nations. In the far east, Japan and other Pacific Rim countries are also challenging the economic supremacy of the western industrialized world. As these economic consortiums develop and free trade continues across all nations, there are increasing demands on each nation to remain competitive in the world marketplace and provide a high standard of living for it's citizens (Thurow, 1 992).

National Goals and Strategies

The challenges of remaining competitive in a global marketplace are being addressed by both the private and public sectors within each nation. Business and industrial organizations are addressing the competitive issue by using new technologies to produce goods and services, moving the processing of information and materials to locations of lower costs, finding niche markets, and customizing products to meet consumer needs, and reducing and reorganizing the workforce (Carnevale, 1991).

In the public arena, the most ubiquitous strategy has been the improvement of workforce quality through a reform of the nation's educational system. In the United States, federal and state legislation has been approved to raise standards of achievement and develop new initiatives for the preparation and continued retraining of the workforce. In Finland, two extensive experimental projects have been launched at the secondary and tertiary education levels. The major concern in both nations is the development of human resources that will enable the countries to remain competitive in Europe and across the global economy.

Organization of Education

Education in Finland. In Finland a national priority has been made to provide equal educational opportunities to all populations in each region of the country. This goal is accomplished through the comprehensive school which provides a compulsory education for all children ages seven through sixteen. A standardized curriculum is taken by all students for further studies beginning at age sixteen in the upper secondary schools or in the vocational schools. The upper secondary school offers a geographically homogeneous three year program of studies which prepares students to take the matriculation examination which is the general criterion for admission to the university. The academic high school students can choose their major areas of studies in languages, mathematics and natural sciences, humanities, sports and gymnastics, music or dance. Students enrolling in the vocational schools may select from twenty-six (26) basic programs within which a total of over 200 very specialized lines of study. The students entering the vocational schools can obtain a diploma after two or three years depending upon their specialization. Upon graduation they may seek employment or continue toward a higher vocational diploma which provides additional preparation in a two to three year program leading to supervisory and managerial roles in their areas of specialization. Students who complete the upper secondary school who are not admitted or chose not to continue their education at a university may also enroll in the vocational schools after graduation for occupational preparation.

All of the schools are located in a separate physical location and have a mixture of ownership and financial support that includes national/state, municipalities, and private ownership. Ninety-two percent of the upper secondary academic schools are funded by the municipal or local government, six percent are funded by private agencies and two percent get their resources from the state (Tilastokesaus, 1993). The comprehensive vocational schools, which offer courses in the technical specializations, are owned and operated by the state or municipal or the federation of municipals. Within a given municipality or region of the country there are also additional types of vocational schools for commercial subjects, health, social services and design and handicraft that may be owned publicly or privately. In 1992, fifty-five percent of vocational students studied in the municipality, or the federations of municipal owned, thirty-five percent studied in state owned and ten percent studied in private vocational schools (Tilastokesaus, 1993).

The curriculum in the upper secondary academic schools is very oriented toward the matriculation examination which requires four compulsory subjects that include Finnish or Swedish (depending upon the school location), a second official language, another foreign language, and mathematics or social studies. Two additional subjects are optional. Academic high school students' three- or four-year programs include a minimum of 75 study units (study weeks with 38 contact hours) in 14 subjects. The study program consists of core courses (30-50%), advanced optional courses (30-40%), and free optional units (10-30%). In the vocational schools the core curriculum also requires the two official languages, Finnish and Swedish, a foreign language, mathematics, physics and chemistry, civics, information technology, physical and health education, and art education. Most of the studies are concentrated in the specific line of specialization.

According to 1991 statistics, fifty percent of the students completing the comprehensive school will immediately continue on to the upper secondary school with the remaining thirty-two percent enrolling in the vocational school, six percent continuing on to the volunteer tenth grade, and twelve percent going to work and delaying their studies. In Finland many of the students graduating from the upper secondary academic high schools are not able to continue their studies at the university because there are not enough study places available for them. Two thirds of all upper secondary school graduates apply for admission but only one third are admitted. Many of these students will then enroll in the vocational schools and colleges. Some students are waiting for a opportunity to be admitted to the universities. This results in redundant education and prolongs the time required for entry into the workplace or the university as evidenced by the fact that one-fourth of the beginning university students are over 25 years of age. The students enrolled in the vocational schools graduate with an intense, high level of knowledge and skill in a very specialized occupational preparation program that prepares them very well for a specific job but causes difficulties when economic conditions are poor or changing workplaces no longer require the specific skill occupational skills.

As a result of these problems and the growing concern about the country's place in the global economy, in particular future linkages with the emerging European Community, policy makers at the national level instituted a plan for the educational system to be developed with "greater clarity and international compatibility. The aim is a simple basic structure with flexibility in individual choice" (Ministry of Education, 1994).

Education in the United States. In the United States public education is a high priority which is organized at the local level under state guidelines with little direct control by the central federal government. Students enter the schools at age five and are required to attend to age sixteen which is the second year of the four year high school. Approximately 90 percent of the students entering high school will complete the four years and obtain a diploma upon graduation. About fifty percent of the high school graduates will continue their education in a four year college or university and about half of these will obtain the first basic degree, the baccalaureate. The remaining will enter the military, obtain employment, or continue their education at a two year community college located nearby which offers a college transfer program and an occupational preparation program. Others may enroll in a private occupational preparation school or a public technical college depending upon the educational organizational pattern of the state. Most of the academic education and vocational education in the United States is located within one school building although several states have a system of separately located vocational education centers for students to obtain occupational preparation in half day sessions and return to their home high schools for their academic preparation (U. S. Department of Education, 1994, p. 62).

The curriculum provided to students in the high schools will vary from state to state and within local school divisions but generally will require for graduation form high school four courses in English (4 units) three courses in mathematics (3 units), two units in the sciences, a course in U. S. history, American government, geography, physical education, with the remainder in electives chosen by the student. A total of 20 units is generally needed to graduate from high school and the required courses will comprise about 12 to 14 units or courses in a typical student program of studies. Students elect vocational courses and would need to acquire a minimum of three (3 units) courses to complete a concentrated program of vocational education leading to employment upon graduation (U. S. Department of Education, 1 993).

The Study

This study was designed to investigate the implications of national policies for workforce preparation of youth in the United States and Finland. The study was conducted by utilizing a traditional evaluation study of policy-oriented research. A retrospective review of past policy decisions were examined by comparing the goals and objectives of the policy before implementation with the performance that actually occurs. Patton and Swicki (1986) called this kind of research design as an ex-post evaluation model where the analysis of policy implementation focused on specific goals and targets for preestablished criteria for known time periods. The research questions to be addressed were: (1) Did the actual performance meet the goals and target performance? (2) What were the internal and external factors that were enhancing or inhibiting the process of workforce preparation in high schools? The outcomes of the study would enrich the understanding of strategies used by each nation in human resource development and serve to enlighten the future formulation of policy and implementation of practice in both nations.

The qualitative data were collected for the research using policy document analysis and a focus group interviews technique as presented by Morgan (1990) and Majchrzak (1984). An analysis was first made of the current national policy documents for preparing youth in the United states and Finland for entry into the workforce. The results of the analysis was used to develop protocols for the focus group interviews. The interviews were conducted among reform stakeholders within three experimental school divisions in Finland and three technical preparation consortiums in the United States. In Finland, the focus groups were selected from the sixteen townships having experiments and three different municipal systems that were representative geographically. The high school units where visitations were made located in the northwest, eastern, and southern areas of Finland. Focus group interviews were conducted with the representatives of the upper secondary and vocational schools (academic and vocational high schools) who participated in the experiments. Supervisors, principals and vice principals, teachers, counselors, and students in each were interviewed in focus groups. The interviews were conducted in combinations of English and Finnish depending upon the language skills of the participants. There were always two researchers present, both of whom had English speaking proficiency and one with Finnish as her native language. The information collected during the interviews was recorded in writing and a report of the discussion was compiled by the researchers. The report was then returned to the experiment coordinators and/or supervisors for their review and verification.

In the United States a similar strategy was used in conducting the focus group interviews. The interviews were conducted among selected technical preparation consortiums representing rural, urban, and suburban areas of a single state. The stakeholders interviewed represented community college and high school administrators, teachers, counselors, and students. The interviews were recorded and summaries were prepared and returned to the participants for their verification.

The results of the focus group interviews were analyzed by first comparing the responses of each of the three groups within each country and the national goals of workforce preparation as identified by the policy document analysis process. The major questions was to determine (1) the level of agreement for each group with the prestated policy goals and objectives, and (2) the consistency of agreement across the stakeholders groups. In other words, what was the perception of the participants in the experiments with respect to the need and underlying rationale for the reform in the secondary schools of Finland and the United States? The research was started with diagnosing the level of intra- and inter-group agreement which would be a possible source of underlying factors associated with any differences between policy targets and performance.

Contemporary Approaches to Workforce Preparation

Experiments in Finland. Finland is currently conducting an experiment in secondary education, providing a wider range of opportunities than before for completing a vocational diploma, upper secondary syllabus or a combination of the two through the collaboration of vocational institutions and upper secondary schools. Sixteen localities which comprise one fifth of the age cohort, are taking part. A wide-ranging experiment in vocational higher education is also in progress, with 22 temporary polytechnics participating. Eighty-four percent of all occupational higher education specializing areas are covered in experiments (Numminen & Piilonen, 1992). The purpose of this experiment is "to raise the standard of higher vocational studies and devise new programs leading to higher vocational diplomas via collaboration between vocational institutions" (Ministry of Education, 1 994a, p. 36).

The underlying rationale and reasons for conducting the experiments in secondary and post secondary education according to the Ministry of Education are the following: prolonged study times, increased dropout, overlapping education, a growing gap between general and vocational education, an excessive number of matriculated school leavers compared with educational opportunities, the underrated status of college-level education in international comparisons, and the lack of flexibility of education in responding to changing skill and knowledge requirements. The purpose of the experiments is to study how inter-institutional cooperation can be used to raise the standard of post-compulsory education and to meet the changing demands for knowledge and qualifications Another objective is to explore possibilities to diversify education and create flexible and individualized programs. One central focus of the experiment is inter-institutional cooperation, with a view to lowering the barriers between different forms of education and offering more options to students (Ministry of Education, 1994b, p. 8).

The Government Development Program (1994) suggested that the education structure will be streamlined and made internationally compatible. The polytechnic program essentially offers opportunities for raising the standard and quality of education. In Finland, higher education will consist of a non-university sector and a university sector. Sixty to sixty-five (60-65) percent of the age group will have access to higher education, one third in the university and two-thirds in the non-university sector (Government Office of Publications, 1991).

Internationalization is the key to a successful policy in Finnish education. The goal is to provide the students of all educational levels with skills needed in global environments. Internationalization of vocational education in Finland focuses on international collaboration and study projects, student and teacher exchange, work practice in another country is included in the study programs, quality of languages study programs, bilateral collaboration with emergent countries, and teaching in many languages (Numminen & Piilonen, 1994). International education has been implemented in diversified ways in Finnish schools. The countries of the European Union are aiming to promote free moving workforce policies in Europe. The European Union countries have started to produce and certify equivalent occupational and professional qualifications in order to enhance workforce mobility and raise standards.

Federal Legislation in the United States. In the United States there is also a growing concern about the level of education need by high school graduates to enter the workforce and have the skills and knowledge required to function in new organizational structures that utilize communication and problem solving skills. The new technologies to produce goods and services will also demand highly trained and skilled workers and their is a concern on the part of policy makers at state and federal levels that American students do not have the knowledge and skills of their international competitor's workforce. This concern was first introduced in a widely distributed and discussed report entitled A Nation at Risk (The National Commission on Excellence in Education, 1983) which began a massive reform movement in almost every state in the United States. One of the most widespread aspects of the educational reform movement was the increase in the number of academic courses required for graduation from high school. From 1983 to 1989 most states in the United States increased the number of courses and developed specific course requirements in academic subjects as a qualification for a high school diploma (Clune, et al., 1989).

In the United States the passage of the Carl D. Perkins Vocational and Applied Technology Act in 1990 stated as its purpose "to make the United States more competitive in the world economy by developing more fully the academic and occupational skills of all segments of the population" (Public Law 101-392. 1990). The basic components of the Act are: (1) the acquirement of basic knowledge and occupational skills through the integration of academic and vocational education and (2) the opportunity to receive additional education by linking secondary and post-secondary technical education curriculums through the concept called "Tech-Prep" Technical-Preparation), and (3) accountability for states and local schools to demonstrate achievement of academic and occupational preparation outcomes.

The Act addresses the challenges of preparing students for employment in a changing workplace by requiring the Federal funds be used for programs that "integrate academic and vocational education ... through coherent sequences of courses so that students achieve both academic and occupational competencies." (P. L. 101-192, 1990) As a result of this provision schools across the United States are now developing various approaches to making connections between the knowledge taught in an academic classroom and the skills learned in the vocational laboratory (Bottoms, 1993; Grubb, et al., 1991).

The Perkins Act provides funding to each state in the United States to deliver Tech-Prep programs where cooperative linkages between secondary and post-secondary educational institutions. These post-secondary linkages may include a two year community college, an apprenticeship program, or a private proprietary school. Most tech-prep programs operate on a two plus two (2+2) concept with two years of a planned series of high school courses that are articulated with a two year community college program leading to an associate of applied science degree (Hull and Parnell, 1991). Across the nation consortiums have been formed with community colleges and high schools planning and delivering tech programs for students to earn a high school diploma and continue their technical education with an associates of applied science degree.

Comparisons of Workforce Preparation

The two countries have embarked on national policies which are intended to keep both nations economically competitive in the global marketplace. In the United States, Congress passed the North American Free Trade Act which established lower tariffs for trade between Mexico, Canada, and the United States. More recently, Finland joined the European Union which will strengthen their economic ties to other member nations in Western Europe. Both nations have a common goal of maintaining strong national economies and are using similar strategies of joining regional geographical economic and political consortiums.

The goal of joining these economic partnerships is to continue providing a high standard of living for the citizens of each nation. In order to accomplish the national goal of economic competitiveness and maintaining a high standard of living for their citizens, both nations have focused their attention on improving the quality of education for preparing young people to enter the workplace. Both nations passed legislation to reform and restructure the educational systems at the secondary and post-secondary levels of education. In the United States the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 was passed with the stated purpose of "making the United States more competitive in the world economy by developing more fully the academic and occupational skills for all segments of the population." (P. L. 101-392, 1990) In Finland, the Finnish parliament adopted legislation to seek alternative solutions to educational development by testing reforms in post-compulsory education. The purpose of the experiments are to study how inter-institutional cooperation will (1) seek greater clarity and international comparability, (2) raise the standard of post-compulsory education to meet the changing demands for knowledge and qualifications, (3) lower barriers between different forms of education and offer more options to students (Ministry of Education, 1 994b).

In comparing the purposes of the federal/state policies for improving workforce preparation one will find similar purposes as well as differences in the intent of the legislation. Both policies are aimed at developing workers for their adapting to the global economy. However, the Finnish goal is to clarify the education received by student so that it will be more compatible with the educational requirements and certification of other nations, particularly those in Western Europe. The purpose of the Perkins Act states very clearly that the intent is to make the United States more competitive or dominant in the world marketplace. This difference in the intent of the purposes may be explained by the geographical proximity of Finland to other European nations and the requirement for common educational standards among the members of the European Union. In the United States, economic and political dominance of the world following World War II to the present has shaped a national concern for continued world leadership among the nations of the world. The relative geographical isolation from most other developed countries does not create the urgent need for the United States to cooperate as is the case in Finland. These factors create a competitive position rather than a collaborative one when defining the major outcomes of workforce preparation reform in the United States.

Both policies emphasize the raising of educational standards with the Finnish strategy for improvement focusing on inter-institutional cooperation while the strategy in the United States is aimed at developing more fully the academic and occupational skills through an integration or interdisciplinary approach. This difference is the result of the need in Finland for expanding the options of secondary students to acquire a broader base of preparation that provides options for workplace preparation as well as continuing their education in the newly formed polytechnics. The aim of this policy is to provide a more practical post-secondary education than the existing university route which is not readily available to a large number of Finnish students desiring to continue their education after completing their secondary schooling. In the United States much public attention has been directed at the lack of "basic skills" among high school graduates and the Perkins Act translates this concern into a strategy which requires academic and occupational skills for improving workforce preparation.

The removal of barriers between different forms of education is a common goal for both the United States and Finland, but the contexts and strategies for implementation in each nation are quite different. In Finland, the separate physical sites for upper secondary academic and vocational education programs with each school having a prescribed state mandated curriculum is problematic in responding to changing skill and knowledge requirements. A new form of upper secondary education is being introduced in the experimental schools which features a movement toward increasing the number of electives available for students, eliminating year long courses, and giving students the opportunity to choose courses in different upper secondary schools. The goal of the experiment is to provide students with more diversified options for a program of studies. Students in an academic high school can take courses in the vocational schools as well as students in the vocational schools taking academic courses. Some students may also choose a combination of academic and vocational courses that provide them with a vocational certificate as well as the academic diploma. The vocational education system has also introduced the concept of flexibility in the experimental schools by reducing the occupational lines of specialization from 250 to 160 occupational preparation programs. Students in several of the experimental schools are allowed to develop a concentration in a major area of specialization and obtain a minor area in another program or cluster. In this approach students will have the flexibility to prepare themselves for qualification to enter related occupational fields and better respond to structural changes in the labor market and shorten the time required to be retrained for another occupation.

A third component of the experimental reforms in Finland is the formation of polytechnic institutions of higher education. This is being accomplished in twenty-two locations across Finland by combining the separate higher vocational education schools offering occupational preparation in allied health, agriculture, forestry, business, etc. into a single administrative unit. The aim is to raise the level of qualifications by combining the theoretical with vocational studies and allow students to develop individual relevant study programs among the occupational areas found in the schools comprising the new polytechnics. For example, a student in forestry could choose courses from business to develop their expertise and preparation to enter management in the forest products industry. The newly formed polytechnics will create more opportunities for students to continue their education after graduation from the upper-secondary school, and link their vocational education coursework with advanced practical and theoretical preparation at the polytechnic institutions.

In the United States the educational reform movement has stimulated an effort to improve the quality of education by reducing the options students have had in the past in graduating from high school. Every state in the nation has increased the basic requirements for high school graduation reducing the opportunities for taking electives such as vocational education courses at the same time. Proponents of educational reform are also recommending that the "general" program of studies be eliminated and students be better prepared to enter the workforce and/or continue their education. These reforms became national policy in the Perkins Act with the tech-prep initiative. The major goal of the initiative is to develop a prescribed program of studies which will include higher levels of mathematics, science, and communication skills and link the occupational preparation courses at the high school level with technical preparation programs at the post-secondary level. In this manner, students in the United States would develop a career path that would better qualify them for entry into the workplace and allow them to continue their depth of specialization through an articulated program of technical studies found in a community college, proprietary school, or apprenticeship program.

Comparisons and Conclusions

In comparing these policies and practices, it is interesting to observe that both nations are seeking to remove barriers within as well as between the secondary and post-secondary schools and programs. In the United States the integration of vocational and academic education and the tech-prep linkages are the strategies being used to accomplish the goal. In Finland the strategy is to develop flexibility for student options and electives through inter-institutional cooperation and administrative consolidation among separate schools and programs at both the secondary and post-secondary levels. The difference in strategies among the two nations is accounted for by the values of the two cultures. In Finland with a relatively small population of five million located in a moderately sized nation, a strong state or federal control of education emerged with prescribed standards for school administration and curriculum which has been quickly decentralized in recent years. The European tradition for in-depth preparation for work or for entry into higher education facilitated the development of a separate system of secondary schools devoted to either academic or vocational preparation. Changes in the economy of Finland, with a severe recession creating large numbers of unemployed and under employed and the necessity to form collaborative economic and political linkages with other nations particularly Western Europe, created the need for more flexibility in preparing students for a rapidly changing environment.

In the United States the formation of a decentralized system of state governments with divergent entities within states created a more localized governance of public schooling. Most communities across the nation began to establish high schools during the early part of the century and federal legislation in 1917 promoted the placement of vocational education in the emerging high schools. The American norm became the comprehensive high school containing both college and workforce preparation programs.

The establishment of a widespread network of community colleges and technical institutes in the United States following World War II provided technical preparation in every state of the country. The availability of these existing programs enhanced the development of local articulation agreements between high schools and post-secondary institutions during the past ten years which eventually became public policy with the tech prep initiative in the 1990 Perkins Act. These developments have produced federal leadership in promoting linkages between secondary and post-secondary programs for workforce preparation funding support to encourage the planning and development of tech prep programs across the nation.

The future prosperity of Finland and the United States is a shared concern among the citizens of both nations. These concerns have been translated into common national goals with both countries seeking economic growth in a competitive world marketplace that provides employment opportunities to continue a high standard of living for members of each society. Both countries have placed priority on improving the quality of education and have approved federal legislative policies and initiatives to address specific concerns about improving the quality of workforce preparation for youth and adults. Each nation has also established a tradition of delivering the preparation of youth for employment through a school based approach at the secondary and post-secondary levels.

Although both nations share common goals and have launched efforts to improve the workforce preparation of youth, the social and political contexts of each country have influenced the development of different policies and strategies to address the issue. The Finnish experiments are aimed at raising the standards of vocational education studies and eliminating barriers between different forms of education that will produce greater flexibility for students and be more compatible with educational systems of the European union nations. The United States has focused on improving the academic as well as the occupational skills of youth belonging to all populations and increasing

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opportunities for highly specialized technical preparation through linkages with post-secondary institutions and organizations.

The strategies for accomplishing these goals in Finland can be characterized as moving away from state mandates to local control with a loosening of rigid curriculum requirements and allowing students more opportunities to elect courses from both academic and vocational schools. The opportunity to continue in an area of in-depth specialization in a technical area is being changed by upgrading post-secondary higher vocational studies into an emerging national system of four year polytechnic institutions of high education. This initiative will also produce greater compatibility with the credentialing systems and standards being used by other nations belonging to the European Union.

In spite of the prevailing recession, Finland is taking up the challenges of the future. The agreement on the European Economic Area and officially joining the European Union in 1995 will increase international competitiveness of Finland and pave the way for closer cooperation in education and research. Finland has chosen the strategy to invest in education and research even during recession.

In the United States the strategies for improving the workforce preparation of youth is focused on reducing the options and electives of high school students by increasing the academic achievement of students through increased graduation requirements and the integration of academic and vocational education courses. Whereas, Finland is in the process of transforming their post-secondary technical preparation programs into the polytechnics, the United States has well established community college and technical college systems and federal resources are being used to strengthen and raise the level of workforce preparation through the development of linkages and articulation of secondary and post-secondary programs with the tech prep initiative. The aim of these efforts is to improve the quality of the workforce in order to better compete in the international marketplace rather than collaborate with other nations in forming common markets and educational credentials.

As both nations move forward in reforming and restructuring the workforce preparation programs for their youth, the outcomes will be dependent upon the effect of the initiatives and strategies being used to implement the goals of each nation's policy. The ultimate goal of both initiatives is to raise the level of achievement and provide a well qualified person to enter the workforce and/or continue their career and technical preparation through a four-year polytechnic institution in Finland or a two-year post-secondary community college or apprentice program in the United States. The results of these reforms in workforce preparation will be a contributing factor in the future economic development and progress of each nation.

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The Association of Social Position to Restructuring Ability and Symbolic Orientation

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Two factors lead attention toward restructuring skill and symbolic orientation. The first is the recognition that successful performance in a high performance workplace is hinged to analytical ability (Marshall & Tucker, 1992). The second is The Bell Curve. It revives questions about the heritability of analytical skill, and the belief that this ability divides according to social class (Herrnstein & Murray, 1994). Analytical skill includes restructuring skill and good skill with symbols.

Questions about analytical skill and symbolic skill have surfaced in vocational education. Zellner and Parrish (1986) mentioned them, while recent attempts to distance vocational education from special needs students seem to echo beliefs that Herrnstein and Murray (1994) tie to social class. The challenge to improve the nation's workforce, though, can not be bound by this logic. Deeper insight and attention to factors that mold analytical ability must dominate professional judgment.

This need is important because notions of competitive advantage differ from in the past. Individuals are not expendable, because the entire workforce must participate in the strengthening of the nation's international stature. Consequently, no matter what they are, factors that contribute to non-performance need to be identified and understood so that pedagogy contributes to the development of analytical skill.

So far, though, McCaslin and Good (1993) saw much educational reform as overly simplistic. Much of it is not grounded in theories of learning or human development. The need for this approach is based on Snow (1989), that complex and demanding tasks call for emotional and psychological resources. Many of them appear to be personality based.

Beyond this point, the value of tech-prep and school-to-work transition seems evident. However, it could, like most methods, be situationally effective if not grounded in knowledge of human growth and development. Because vocational reform has been driven by valid employer and teacher concerns, a move to incorporate this knowledge would depart from recent practice. However, Gagne (1980) would confirm the need for this thinking with the idea that a lack of insight to this complex issue limits progress. Until depth of understanding emerges, the progress that Marshall and Tucker (1992) envision for the workforce could be difficult to achieve.

The need for this study, then, is based on the belief that progress in the development of high performance skill requires vocational education to delve into developmental factors that influence analytical ability, such as restructuring skill and symbolic orientation. The idea that these attributes are linked to social class has some support (Herrnstein & Murray, 1994; Marshall & Tucker, 1992).

The common view that students will rise to higher expectations is difficult to support. Theories of personality and cognitive style show that aptitude for high performance requires the types of psychological and emotional resources Snow (1987) hypothesized. Some of them could relate to social position because, while people are products of their environments, this includes the way personalities are organized and how people learn to cope with advanced skills.

Background

The theoretical framework used in this study came from Witkin's field-dependence theory (Witkin & Goodenough, 1981), Holland's (1985) congruence theory, and Bloom's (1984) view of higher-order cognitive objectives. The field-dependence construct examined cognitive restructuring skill (Witkin & Goodenough, 1981), an ability Bloom indicated as essential to higher-order problem solving. Holland held that people seek environments that reinforce their personalities and interests. Using congruence to frame this study, then, the intent was to determine how it relates to restructuring skill and attitudes toward symbols as a source of meaning.

Theoretical Base

If students have learning abilities and interests that are incompatible with task demands, Cronbach and Snow (1977) feel that they have an inaptitude. This inaptitude would include restructuring skill. Bloom (1984) stated that people must restructure knowledge to solve cognitive objectives at or above the application level. Restructuring is the ability to independently reorganize a new problem into familiar terms and to then select appropriate principles or concepts to frame a response. This ability could be an aspect of fluid ability, an element of general intelligence that enables the transformation and manipulation of knowledge (Cronbach & Snow, 1977; Herrnstein & Murray, 1994). It would be a psychological resource in a problem solving situation.

Bloom (1984) also believed that students need to demonstrate mature judgment, self-confidence and self-control. These would be emotional resources in a higher-order task situation. They would be used to achieve the focus, concentration, and discernment on analytical work. However, because someone has requisite psychological and/or emotional attributes does not guarantee that they will be used (Messick, 1987). Yet, those who lack them could face a challenging adaptive situation.

Because they are personality-based, some psychological and emotional resources could be difficult to develop. These behavioral patterns can be automatic by middle teenage years and thus difficult to modify (Ginzburg & Opper, 1978; Witkin & Goodenough, 1981). If they are seen as volitional, psychological and emotional resources can be keys to the enduring motivation that Hilgard (1987) saw as easily undervalued.

Beyond heritability, social learning theory is important in this regard because it suggests that, as indicators of analytical skill, restructuring and symbolic orientation are predominately socially acquired (Lohman, 1992; Witkin & Goodenough, 1981; Hill, 1981). Indeed, Bandura (1986) believed that modeling affects the development of cognitive skill. If symbolic memory is added, the skills needed for the workforce could reflect social position.

Kagan and Lang (1978) believe that youths develop skills normally found in their everyday lives. Witkin and Goodenough (1981) suggest that analytical skill, which is a component of the field-independent cognitive style, is developed in a social context. It seems to be acquired by being nurtured toward self-directed behavior. Those with limited restructuring skill or symbolic orientation would lack these experiences.

Poverty, latch-key status, or intrusive social conditions, which are common, produce psychological dependence at disproportionate rates for females and special needs students (Ginzburg & Opper, 1978; Kagan & Lang, 1978; Witkin & Goodenough, 1981). These experiences may cause students not to have clear self-definition and an independent goal orientation (Witkin & Goodenough, 1981).

Holland (1985) suggested that behavior change is difficult to sustain because people often lack sufficient and sustained reinforcement. Thus, while Messick's (1987) reasoning suggests that analytical skill could be a personality trait, restructuring skill and symbolic orientation could be difficult to develop if an individual has a narrow range of adaptive skills. Based on this perspective, this study addressed these two basic questions:

1. Is there a correlation between social position and restructuring skill as reflected by GEFT score?
2. Is there a correlation between social position and symbolic orientation?

Secondary marketing education students were selected for study because they fulfill two important criteria. One, congruence theory predicts that students who enroll in people-oriented courses, like marketing education, have a social cognitive style that portends limited restructuring skill. Two, observation suggests that many marketing education students have limited interest in symbols as keys to meaning-making.

Method

Population. Students were intact groups in marketing education programs in five schools located in Georgia. Of 365 students, 204 were female and 135 were male, while 26 were not identified.

Instrumentation. Data were collected with the Group Embedded Figures Test (GEFT), the Educational Style Preference Inventory (ESPI), and the Hollingshead Index of Social Position. Zytowski and Borgen (1983) encouraged researchers to use test and self-descriptive information to study issues related to readiness. This approach was used in this study.

Restructuring was determined by the Group Embedded Figures Test (GEFT). The GEFT has satisfactory reliability (.89 on test-retest over a three year period) and validity (a correlation of .82 between the two major subsections) (Witkin, Oltman, Raskin, & Karp, 1971). Scores range from 0-18, with 0 to 3 indicates low restructuring skill and a field-dependent cognitive style. Scores from 15 to 18 indicating high restructuring skill and a field-independent cognitive style.

In addition, four sub-scales from the ESPI were used to assess attitudes toward words and numbers (average reliability was .7600). The ESPI was adapted from Hill's (1981) educational cognitive style test and was used. Hill's inventory had problems of validity and reliability (ACT, 1978; Clark & Sheriff, No Date) that Fritz (1992) addressed. Fritz named his version the Educational Style Preference Inventory to differentiate it from Hill's inventory.

Students rated their preferences on the ESPI on the four scales for Theoretical Symbols--reading words, hearing words, reading numbers, and hearing numbers. Words and numbers are learned through two sensory modalities, audio or visual. Five point scales were used to achieve this objective. They ranged from 5 ("Usually") to 1 ("Rarely").

Hawkins, Best, and Coney (1989) reported that the Hollingshead Index of Social Position is widely used to indicate a family's overall social position in a community. A score is derived by combining parental occupation and education scores after they are rated on a 1-7 continuum. Occupation is weighted by a factor of seven, and education by a factor of four. Appendix A indicates the categories and data for the sample.

Procedure

Standardized test administration procedures were used to collect data. For the GEFT, they were the methods outlined by Witkin et al. (1971). Students completed the GEFT first. It has three timed sections, one for practice and two for actual scoring. Then, instructions developed by the investigator were used to complete the ESPI and to collect demographic information. The data collection process required about 45 minutes.

The investigator hand scored the GEFT and recorded scores on the computer scan sheets that students used for the ESPI. Data were then tabulated and processed through The University of Georgia Educational Research Services Laboratory. Cronbach's alpha, descriptive statistics, correlations and MANOVA were used to evaluate data. These methods are consistent with prior research of this type.

Findings

There was a negative and moderate correlation between GEFT and social position, as indicated on Table 1. It suggests that higher GEFT score correlated to higher social position score. Scores on social position are scored inversely, thus explaining the negative association. One reason the correlation was modest is suggested by the standard deviation. The data was skewed and was therefore compressed along the range. The mean for social position was in the lower-middle strata, with most students being in the middle to lower social position. The mean for GEFT was slightly below the mid-point on the 0-18 range and skewed toward the lower end.

Table 1
Correlation: Social Position by GEFT

	M	SD	r	Prob.	n
GEFT	7.2626	5.0757	-0.1801	0.00008*	346
Social Position	50.7507	13.4484		p>.05*	

For question two, Table 2 shows that there was a statistical correlation between social position and symbolic orientation with regard to reading words. Because high social position score means membership in a lower strata, the data suggest that a lower preference for reading to gain understanding correlated to high social position. Social position was defined by parental education and occupation.

Table 2
Correlation : Social Position to Symbolic Sub-Scales

	r	Prob.	n
Read Words	0.14028	0.0116*	323
Hear Words	0.04194	0.4526	323
Read Numbers	0.02149	0.7004	323
Hear Numbers	0.04308	0.4411	322
		p>.05	

Table 3 shows that the mean for reading words was toward the middle of the 0-5 range. This signified moderate preference, because the scales read from a high of "Usually" to a low of "Rarely." In addition, the standard deviation indicates that scores were weighted toward the lower end of the scale, also signifying less preference to read words to derive meaning.

Table 3
Symbolic Orientation Basic Statistics

	M	SD	n
Read Words	2.5984	1.1590	338
Hear Words	2.7367	1.0378	338
Read Numbers	2.6834	1.1803	338
Hear Numbers	2.7737	0.8869	337

Statistical relationships were found between social position and restructuring skill and between social position and symbolic orientation for reading words to derive meaning. These findings are the focus of discussion in the following section.

Discussion and Recommendations

The findings of statistical relationships between social position and restructuring skill is consistent with expectation, but the finding for symbolic orientation was not. This finding deviated from convention. In general, though, the data means and standard deviations indicate that many of these students had moderate restructuring skill and moderate interest in reading. Overall, this suggests limited aptitude for complex and demanding tasks, thus confirming the need to identify specific psychological and emotional factors that affect skill development.

While the general portrayal of limited analytical skill to social class is understood (Herrnstein & Murray, 1994; Marshall & Tucker, 1992), this study went further by isolating components of analytical ability in newer ways. Restructuring ability, which Bloom (1984) equated with effective performance on advanced tasks, could be an aspect of what Lohman (1993) called fluid ability. This is the general all-purpose ability to learn and to perform on advanced tasks.

Students could have good symbolic skill, but the absence of restructuring ability almost ensures an inaptitude with the mechanics of an analytical task. The reasoning ability associated with analysis, though, is portrayed by Witkin and Goodenough (1981) as part of a comprehensive personality structure. A large number of these students do not have that structure.

Reading develops vocabulary and facilitates understanding. Moderate interest in reading, while not stating that students have trouble reading or that they have a limited vocabulary, moves toward the volitional arena, toward the automatic behaviors students bring to task situations. Combined with low prefer-ence for new and ambiguous tasks, students who have a limited vocabulary could find the demands in a high performance task outside their developed abilities and interests. The challenge to instructors, then, is to forge new preferences for students.

One way to mold new skill is to reinforce existing learning strengths and abilities because they reflect present aptitude. Snow (1989) encourages this approach, as did Witkin and Goodenough (1981) in their discussions about cognitive style. Indeed, Fritz (1994) called for the development of vocational programs that reinforce social as well as analytical interests. Because aptitude for high performance tasks is not program-specific, students who have limited restructuring skill might benefit more from programs that call for their developed preferences and skills.

Snow (1987) was clear that advanced tasks call for personality-related attributes. Kagan and Lang (1978) report that, due to developmental experience, some students do not have access to role models that encourage semantic memory. The same could be true for restructuring skill. Given this void, teachers must recognize that they have a personality enhancing role to fulfill for many students. Without instructional support, some students will not mold the psychological and emotional attributes they need for high performance tasks.

While this group of students was enrolled in marketing education, students with these traits are found in all vocational programs. Fritz (1981) indicates that they also enroll in home economics, while students with good restructuring skill enroll in Agribusiness and several Technological Studies programs. Marketing education and home economics may attract more students with limited restructuring skill, as Witkin and Goodenough (1981) hypothesize, because they emphasize people in their content-base.

The absence of restructuring ability portends a social learning style and limited tolerance for new and ambiguous tasks (Witkin & Goodenough, 1981). In addition, moderate to low interest in reading suggests that learning in this manner is not, as mentioned, an automatic behavior for many students. Because analytical skill requires both restructuring and reading ability and interest, both traits must be developed.

If high performance is a legitimate educational goal, attention to congruence factors and personal motivators is important. The type of information provided here is diagnostic. It should be used to interpret the impact of past experience, including non-school developmental conditions at home and in the community, as they form personality. A high performance workplace requires that individuals have a strong orientation toward analytical tasks. It is most desirable that it be automatic. When it is not, the challenge is to not only build new skill, but to motivate the types of interest students need to have access to these occupations. In many ways, this means developing or supplementing an existing personality structure.

In close, this study adds insight to discussions about analytical skill that has implications for classroom teachers and teacher education programs. Because little attention has been given to characteristics of the learner in vocational research, this study might encourage others to recognize how social experience molds learning habits.

Recommendations

To extend the knowledge acquired from this exploratory study, it is recommended that the following be conducted:

1. A study to establish relationships between reading preferences and vocabulary for technical occupations.
2. Identify the level of influence vocational teachers have on student's decisions to develop high performance skills.
3. Determine the relationship between restructuring skill and persistence on high performance cognitive tasks in a vocational environment.

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Appendix A

Social Strata	Range of Scores	Population Breakdown
Upper	11-17	3.0
Upper-Middle	18-31	8.0
Middle	32-47	22.0
Lower-Middle	48-63	46.0
Lower	64-77	21.0
Sample M = 50.7507	SD = 13.4484	n = 349

Occupation Scales (Weight of 7)

Higher executives of large concerns, major professionals	1
Business managers, prop. med bus, less professionals	2
Administrators, small bus owners, minor professionals	3
Clerical/ sales, technicians, and owners of small business	4
Skilled manual employees	5
Machine Operators and semiskilled employees	6
Unskilled employees	7
Professional (Graduate School, M.D., Ph.D., LL.B., etc.)	1
Four-year college graduate (B.A., B.S., B.M.)	2
One to three years of college (also business schools)	3
High school graduate	4
Ten to 11 years of school (part high school)	5
Seven to nine years of school	6
Under seven years of school	7

SP score = (Occupation score x 7) + (Education score x 4)

Factors That Influence Women's Choice To Work in the Trades

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Women's work patterns have been changing radically over the past several decades. Historically, women who worked outside the home have been employed in traditional female work roles. These jobs are typically in the low-paying, low-status, clerical, retail, and service sectors. In comparison, male-dominated occupations are traditionally higher paying and higher status jobs than the female-intensive occupations. "It is still true in the United States that many jobs are clearly labeled as 'women's jobs' or 'men's jobs'. Male jobs are more numerous and are typically higher in both status and income than are traditional women's jobs' (Bee, 1992, p. 289).

Occupational segregation has contributed in large part to limitations being placed on the occupational achievement of women, chiefly causing a pay gap between men's and women's wages. In 1991 women earned 70 cents for every dollar earned by men, up from 59 cents in 1963. These statistics indicate that 30 years after the passage of the Equal Pay Act of 1963, much work remains to be done to close the earnings gap between men and women.

To overcome employment inequities and to further their career development and career opportunities, many American women are now looking beyond the traditional feminine working roles. According to Zunker (1990) an emerging trend in women's employment is toward "equalization of job opportunities, particularly those jobs that are predominantly held by men" (p. 382).

As more women join the workforce and choose male-intensive occupations, the blue-collar trades, once the domain of men, are becoming one of the nontraditional job choices of females. A trade is "some line of skilled manual or mechanical work; craft" (Webster's College Dictionary, 1991, p. 1413). For this study, a trade is a manual occupation in which the learning process can be acquired through apprenticeship programs or on-the-job training.

The trades offer many advantages to workers who choose these jobs. As cited earlier, a major benefit of working in the trades are the wages, typically two or three times what a woman can expect to earn in a traditional female job. Trades requiring a license need only a high school diploma or GED. In trades requiring apprenticeship training, apprentices are well-paid during the training period. Other advantages include opportunities for advancement and job training which is recognized throughout the United States (Green, 1992). Strengthening this occupational option for women are current economic indicators which are showing an increased need for skilled trade workers over the next two decades (Martin, 1988).

Along with these advantages, however there are hazards and harassment for the women who choose to work in the trades. By going outside the feminine workroles, tradeswomen endure and overcome frustrations and obstacles unique to their job choices. Gutek and Larwood (1987) report that "a variety of attitudes and behaviors still set up barriers to women's optimal career development, and particularly to their participation in nontraditional occupations . . . A woman trucker was fired 'for her own good' after release from a hospital following a beating and rape near her disabled vehicle . . . company mechanics had refused to repair the vehicle" (p. 23).

Clearly, there are barriers to women in nontraditional trades. Sparks (1984) cited the following deterrents to women entering the trades: (1) their own upbringing and sex-role stereotyped attitudes, (2) family pressures, (3) male ridicule, (4) employer skepticism or opposition, (5) lack of awareness of the requirements and rewards of these occupations, and (6) low self-confidence and an overwhelmed sensation.

Given that females are not socialized into considering the trades as occupations, that access to such jobs is difficult at best, that once admitted, women experience sexual harassment and other workplace hazards, one wonders what influences a woman to make this job choice.

Statement of the Problem and Purpose

In spite of the many difficulties faced by women who work in the trades, there are women who choose these occupations. Thus, this question is raised: Are there unique factors present in a woman's life that influence her to choose to work in the male-dominated trades? We know that economic factors strongly influence many women in choosing their workroles. However, studies indicate a growing number of females are choosing the trades because of personal ambition and job satisfaction (Zunker, 1990).

The purpose of this study, then was to identify factors influencing a woman's decision to work in the blue-collar trades. The following research questions guided the study:

1. What personal characteristics do these tradeswomen have in common?
2. What family influences were dominant in the job choices of tradeswomen?
3. In what way, if any, did role models contribute to women's choices to work in the trades?
4. To what extent was career guidance a factor in the job choices of women working in the trades?
5. Were other societal factors influential in the job choices of tradeswomen?

Methodology

As the goal of a qualitative researcher is to better understand human behavior (Bogdan & Biklen, 1992), a qualitative research design was selected as the most appropriate approach for this study.

The phenomenological approach used here permits the researcher to try "to gain entry into the conceptual world of her subjects" (Bogdan & Taylor, 1984, p. 31). This approach is an effort to understand and interpret how research participants make meaning of their experiences. This study sought to uncover the participants' view of the factors influencing their job choices.

This study employed a semistructured type of interview guided by a list of questions to be explored. Exact wording nor the order of the questions were determined ahead of time. In this way, the researcher is able to respond to the situation at hand and to new ideas on the topic (Merriam, 1988). The set of questions was open-ended but carefully worded with the intention of eliciting from each participant information identifying factors influencing their decision to work in the trades. this provided the opportunity for the participants to answer in their own terms. The interviews focused on the participants' personal characteristics and external factors affecting their job choice.

The interviews were tape recorded, with the permission of the interviewee, and transcribed by the researcher. Each interview lasted approximately 45 minutes to two hours and was conducted at a site agreed upon by the participant and researcher.

Since in qualitative research, inquiry typically focuses in depth on relatively small, information-rich samples, participants were deliberately chosen based on the information they could potentially provide. "The logic and power of purposeful sampling lies in selecting information-rich cases for study in depth" (Patton, 1990, p. 169). For this study, then, ten adult females employed in trade occupations were selected. Participants were located using a chain sampling technique involving the researcher's personal and professional networks and those of the participants. The following tradeswomen were interviewed: an auto repair mechanic, a truck driver, two carpenters, two plumbers, an electrician, a heating and air conditioning technician, a sign maker, and a computer technician. The following criteria were used in sample selection:

1. Participants were employed full time in a trade occupation. Union and nonunion members were sought.

2. Participants were employed in a trade occupation for at least one year. Employment by the participant for at least one year was assumed to indicate job commitment.

This study utilized the constant comparative method of data analysis (Glaser and Strauss, 1967). Each interview was transcribed immediately upon completion and the data analysis begun. To identify data, each incident pertaining to the purposes of the study was coded. After the first interview, transcripts were examined for incidents that stood out and seemed important to the participant. After seven of the interview transcripts were analyzed, it was apparent that the main ideas at that time would become categories. The remaining three interview transcripts yielded no new information. The categories established were (1) related to the purpose of the study, (2) mutually exclusive, (3) conceptually congruent, and (4) exhaustive, with all pieces of relevant data placed in them.

Findings

Four major categories emerged from the data collected and analyzed from the interviews with the ten tradeswomen: (1) perceived innate ability, (2) strong sense of self, (3) desire for independence, and (4) role models.

Perceived Innate Ability. Perceptions of natural ability to perform the trade chosen by each woman was a significant factor in her choice of that occupation. "Perceived" as used by participants meant they feel they were born with this ability. Even though they all had some kind of training for the occupation, either on-the-job, a union apprenticeship program, or technical school classes, they all told how easy it had been for them to learn the trade. The innate ability to do the trade worked as a motivator and served as an incentive to choose that trade as an occupation.

Strong Sense of Self. A strong sense of self emerged as a personal characteristic common to these women which influenced their job choices. Having this strong sense of self enabled the women to face and overcome problems arising from sex-role stereotypical attitudes prevalent in society. Each woman had a high regard for herself and a high degree of self-satisfaction with who she is and what she does. Participants stated outright that they did not care what other people thought of their occupations. These women were sure of themselves, never questioning their ability to carry out their occupational choices.

Desire for Independence. Working in the trades gave these women the independence which they sought and which in turn strong influenced their job choices. Feeling a sense of autonomy and having freedom was important to these women.

Role Models. Role models were clearly important in these women's choices in providing them with acceptable patterns of behavior not restricted by gender and also by providing support for their individualistic choices. What also surfaced was the presence of persons in the lives of these women who demonstrated that individuals were not restricted in their behavior because of gender. The role models for the study participants ranged from mothers to fathers to aunts to teachers with the significant commonality being support and encouragement for *whatever* their work choices were.

Discussion

In addition to the four categories emerging from the interviews in this study, four additional factors deserve some discussion. First, the influence of family members as role models was notable in this study. Mention of family influence on occupational selection can also be found in the literature in Roe's (1956) theory of occupational choice. For the women in this study, those family members mentioned served not only as role models but also provided influence that was inspirational for their workrole pursuits. Second, it is significant to note that career education/counseling was not a factor in participants' decisions to choose the trades. Third is background characteristics. Frequently, studies of professional and college women (Lemkau, 1983; Chusmir, 1983) have indicated that most females who choose nontraditional occupations are firstborn, eldest, or only children. Significant in this study is that only three of the ten women interviewed were firstborn. Fourth, economic factors often contribute to the decisions of individuals to find and secure productive workroles. In this study, however, rather than emerging as a separate category, economic factors were linked to the desire for independence for these women.

Implications

In a discussion of the implications of this study it is important to keep in mind that those women who seek careers in the skilled trades are, indeed, a small group. It is also important to remember that this job choice is not an appropriate one for all women.

The theoretical significance of this study is its contribution to the understanding of women's choices to work in male-dominated occupations, specifically the trades. As choice is part of the process of career development, this study contributes to the knowledge base of career development theory. Career development theories have historically been based on white, middle-class male models and are not tied to today's reality of both a more diverse workforce and ever-increasing opportunities for women to enter nontraditional occupations.

The practical significance of this study is its contribution to career counseling, particularly in reducing and eliminating occupational segregation and stereotyping. As participants in this study worked in occupations other than their present one, the issue of multiple career patterns should be addressed. Career counseling, beginning at the elementary school level, could facilitate the transitioning process by bringing an awareness to individuals of work roles and options regardless of gender.

Finally, this study can also contribute to the establishment of programs and curricula for women entering nontraditional vocational training programs. In particular, this study has shown (1) the importance of self-esteem development for women thinking about choosing male-dominated occupations, and (2) the magnitude and relevance of role models for nontraditional occupational choices.

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Ideology and Vocational Curriculum: Problems, Politics and Possibilities

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Introduction and Statement of the Problem

In *Ideology and Curriculum,* Apple (1990) argued the dominant technocratic model of curriculum is a historical, tightly controls teaching and learning lacks critical reflection, and considers knowledge to be an objective realm of facts. In addition, he found the current trend of more closely linking curricula to the needs of business and industry problematic. Apple rejected the instrumental view that schools should be committed to efforts for increasing social and economic efficiency; however, he did not investigate curricular issues concerned with vocational education.

Some contemporary scholars concerned with vocational education have embraced a critical perspective similar to the one described by Apple (1990) and have renewed the debates over the purpose and substance of vocational curriculum that emerged in the late 1800s (e. g., Bettis & Gregson, 1993; Gregson, 1994; Lakes, 1991, 1994). Nevertheless, specific publications concerned with the development of vocational curriculum (e.g., Giachino & Gallington, 1977; Norton, 1985) seem to represent the instrumental view because they believe vocational curriculum should "provide students with specific job skills, behaviors, values and attitudes to create a 'properly' skilled and socialized work force" (Simon, Dippo, & Schenke, 1991, p. 5). Further, these publications describe only one approach to the development of vocational curriculum: the technocratic approach.

Those concerned with the transformative capabilities of vocational education have found the technocratic approach to curriculum development problematic for several reasons. First, it has not historically recognized the possibility for a vocational curriculum to assist in transforming work organizations and society to reflect participative, democratic values. Second, the technocratic approach to the development of vocational curriculum has traditionally made the interests of students subservient to the interests of employers and, consequently, has maintained the status quo. Finally, because the technocratic approach to developing vocational curriculum has generally failed to distinguish between education and training it has reinforced the dualism of academic and vocational education.

Purpose and Theoretical Framework

Using critical theory as its framework, this paper (a) investigates how the technocratic approach in the development of vocational curriculum contributes to problems that hinder meaningful learning and teaching, (b) acknowledges the political nature inherent in curriculum development, and (c) explores alternative approaches to developing vocational curricula that promote democratic possibilities.

Educational Implications: Problems

Currently DACUM (Developing A Curriculum) and task analysis are used extensively to determine curriculum content in vocational education programs (Finch & Crunkilton, 1989). DACUM is a process in which experts from the same occupation work in a focus group to develop curriculum content and systematically construct a skill profile that later serves as a curriculum plan (Norton, 1985). Task analysis is similar to DACUM in that it collects data from experts in the field. However, this process requires surveying a sample of occupational experts to produce a duty task list (Finch & Crunkilton, 1989).

Task analysis and DACUM are effective methods for identifying important technical skills. However, some advocates of these technocratic methods fail to recognize the value of integrating occupational and liberal studies so that students gain insights into the diverse connections among the worlds of school, work family, and community (Posner, 1988). As a result, when the technocratic approach to curriculum development is not used in conjunction with other approaches, it contributes to several problems that hinder meaningful learning and teaching.

One problem with the technocratic approach to curriculum development is that it "fractionates" instruction because it encourages vocational teachers to teach their respective content area in cells with little or no connection to academic subjects. As a result, the technocratic approach to curriculum development has reinforced the dualism between academic and vocational education (Rosenstock 1991). Though Dewey (1916) contended that vocational education has the potential for becoming the most powerful pedagogy for learning he feared that the instrumental approach to schooling promoted a dual system. A system in which academic and vocational education were separated and decontextualized. Based upon recent evaluations of education in general and vocational education in particular, there seems to be evidence that Dewey's concerns were well founded (Commission on the Skills of the American Workforce, 1990; US Department of Education, 1994).

The technocratic approach to curriculum development tends to fractionate knowledge by emphasizing specific jobs rather than career clusters. Such methods as task analysis and DACUM have been criticized for promoting narrow vocational programs that decrease career options rather than creating career clusters that increase career options. In addition, there is evidence to suggest that future workers will work in less defined environments and thus will need broader skills such as creative thinking, decision making and cooperative problem solving (Berryman & Bailey, 1992; Commission on the Skills of the American Workforce, 1990; Samper & Lakes, 1994; Wirth, 1992).

A second problem with the technocratic approach to curriculum development is that it "decontextualizes" subject matter. Cornbleth (1990) stated that decontextualization of curriculum occurs conceptually and operationally. She stated that conceptual decontextualization occurs when curriculum is perceived as product (e.g., course of study) and is separated from policy-making design, and practice. She stated that operational decontextualization occurs when curriculum fails to recognize its structural and sociocultural contexts. Cornbleth contended that decontextualization of the curriculum emerged in the late 1800s and became established by the 1920s. This was the same time period that work was decontextualized through scientific management.

Historically general and vocational educators have been enamored with "scientific methods." Similar to the products being constructed on the assembly line, many educators became convinced that separate elements of the curriculum could be constructed one at a time and then be assembled to create the desired whole (Cornbleth, 1990). However, just as there is now considerable evidence that assembly-line workers become alienated from their work because it lacks meaning, evidence has emerged that students also become alienated from school "work" because it lacks meaning (Commission on the Skills of the American Workforce, (1990); Raissiguier, 1994).

Many vocational education students fail to find "industry-driven" curriculum meaningful to their everyday lives because it fails to recognize differences within communities and cultures (Gregson, 1994; Simon & Dippo, 1987). The prevailing conception of curriculum within vocational education is as a product, a plan or course of study. While teachers either develop or have access to elaborate tasksheets, transparencies, information sheets, and tests; biographical, structural, sociocultural, and historical contexts are ignored (Cornbleth, 1990). The technocratic approach does facilitate the development of units, lessons, and tests because it fragments complex acts into discrete elements. However, similar to the excellence or quality movement in industry, the movement toward contextualized teaching/learning and authentic assessment in education has provided evidence of extensive limitations to the "scientific" approach. Specifically, recent research by cognitive scientists has suggested that students who participate in learning experiences based upon the technocratic approach have difficulty transferring academic concepts for solving real world problems (Berryman & Bailey, 1992; Raizen, 1984).

Nevertheless, recent studies have reported successful instances in which science, math and communication concepts have been effectively integrated into vocational curriculum (Bottoms, Presson, Johnson, 1992). However, in part because the role of social studies seldom seems to be considered in occupational studies, integrated curriculum is void of the conflict that exists in our society and places of work (Gregson, 1994).

A third problem then with the technocratic approach to curriculum development is that it fails to inform students of the historical conflicts that have contributed to the struggle for freedom, social justice, and equality. Because vocational curriculum provides students with the opportunity to learn about particular trades, it also provides students with the opportunity to examine collective struggles of unions, crafts people, and artisans (Herschbach, 1994). Not only should the struggles of these various groups be addressed but their successes should also be discussed to encourage students to become actively involved in shaping their working lives. Apple (1992) suggested that the nature of conflict has usually been presented to students in a negative way and he believed that this perspective was misleading particularly in a pluralistic society. "The explicit focusing on conflict as a legitimate category of conceptualization and as a valid and essential dimension of collective life could enable the development by students of a more viable and potent political and intellectual perspective from which to perceive their relation to existing economic and political institutions" (p. 99).

A fourth problem with the technocratic approach to curriculum development is that it promotes treating students as empty vessels to be filled with knowledge. Specifically, the language and structure of technocratic curriculum encourages vocational teachers to use an assembly-line approach to teaching that requires students to memorize information and regurgitate it on command. Freire (1985), and later Hooks (1994), described such practice as banking education because it requires the deposit and withdrawal of knowledge. While those concerned with justice oppose banking education for democratic reasons, cognitive scientists oppose banking education because they find it hinders learning (Berryman & Bailey 1992; Raizen, 1989). Admittedly, in particular vocational settings, the practice of certain safety procedures and acquisition of specific technical skills, may promote a mentor-protégé relationship. However, even in this context, learning can be dynamic as well as reciprocal.

A fifth problem with the technocratic approach to curriculum development is that it deskills the teaching profession. Those who hold the instrumental view of schooling fail to recognize teachers as professionals and fear that educators will "contaminate" the curriculum (Giroux 1988). Consequently, one reason instrumentalists advocate curriculum be industry-driven is so teachers will be removed from its development. Not only does the technocratic approach to curriculum development remove control of instructional content from the teacher but, in some instances, industry-driven curricular materials have been scripted to the extent that teachers have little input concerning the delivery of instruction (McCutcheon 1988). As a result, when such "teacher-proof curriculum" is required by state agencies or administration, teachers are forced to transmit authoritative knowledge to students rather than engage them in inquiry and discovery (Berryman & Bailey, 1992).

Educational Implications: Politics

Advocates of the technocratic approach to curriculum development have contended that curriculum planning can be "scientific" and "objective." In contrast, critical theorists have argued that curriculum is inherently political (Apple, 1990; Freire, 1985; Ciroux 1988). For instance, both task analysis and DACUM utilize occupational experts to make decisions for and about those who lack their industrial knowledge. Critical theorists have echoed Dewey's (1916) claim that such a process uses vocational education as an instrument for perpetuating the existing industrial regime instead of operating as a means for its transformation (Gregson, in press; Simon, Dippo, & Schenke 1991).

For example, the technocratic approach has not allowed for the exploration of alternative perspectives of workplace conditions. Rather, it has maintained the status quo. This is so even though there is evidence to suggest that the majority of workplaces in the United States still reflect the factory model developed in the early 1900s and need to be transformed (Adams & Hansen, 1994; Commission on the Skills of the American Workforce, 1990; Wirth, 1992).

Shor (1988) not only argued that vocational curriculum economically reproduces stratification, but he also contended that it retards alternative thought. Similar to Oakes (1985) and Bowles and Gintis (1976), Shor asserted that working class students are channeled into vocational programs where the curricular focus is on narrow skills training for low skill, low wage work. Such a curricular approach is political in one respect because it "emphasizes the production, organization and regulation of human capacities to fit the existing social and technical relations and material conditions of the workplace " (Simon, Dippo, & Schenke, 1991, p. 6). Consequently, critical theorists perceive curriculum far from being neutral.

Burge and Culver (1994) not only contended that schools reproduce restrictive and oppressive practices in general, but they also provided evidence that schools generally preserve and strengthen rather than reduce or weaken gender stereotypes. Admittedly, since 1976 gender equity has become a legal mandate for vocational educators. However, numerous research studies have suggested that gender equity is actually a low or nonexistent priority for the majority of those in vocational education (Burge & Culver, 1994; Raissiguier, 1994; Valli, 1986). Burge and Culver (1994) cited research in two areas that support this assertion. One area they referred to was an American Association of University Women (AAUW) publication, *How Schools Shortchange Women* (1992), that stated seven of the eight vocational program areas remain predominantly the traditional gender. Burge and Culver also made reference to a study that provided evidence that women almost never are enrolled in higher-paying trades like electrical or automotive technology. Raissiguier (1994) and Valli (1986) described the skills taught in vocational programs heavily enrolled in by women, such as business occupations, traditionally as low level, narrow, specific, and not easily transferable.

Another respect in which vocational curriculum is inherently political is that it generally requires little or no creativity, analysis, or independent thought (Shor, 1987). Working class students then are exposed to curriculum that encourages passivity and discourages independent thinking. Such curricular practice "prepares them to take orders, follow rules, obey the decisions of superiors, and look to the knowledge of experts" (p. 25). Passive students become passive workers because they fail to develop a critical relation to curriculum, society and work (Herschbach, 1994; Shor, 1992; Wirth, 1983).

The technocratic approach to curriculum then is also political in nature because it is committed to linking school with the needs of industry by producing a "scientifically engineered" curriculum (Bennett & LeCompte, 1990). Technocratic curriculum is recognized as efficient because it excludes subject matter that working class students do not need to fill their probable social and vocational roles. For example, several curriculum centers fail to include liberal arts in the vocational curriculum they develop in part because it is perceived as wasteful.

While the focus of this paper has been on the formal development of curriculum, it would be a serious omission if this text did not at least acknowledge the existence of the hidden curriculum. Giroux (1983) defined the hidden curriculum as "those unstated norms, values, and beliefs embedded in and transmitted to students through the underlying rules that structure the routines and social relationships in school and classroom life" (p. 47). Consequently, the hidden curriculum is conveyed through the social interaction between educators and students. For example, there is evidence that vocational education enrollment and practices serve to reinforce current gender, class and minority group inequalities (Bowles & Gintis, 1976; Oakes, 1985; Shor, 1987}.

Those who have written on the hidden curriculum have also recognized that some content is hidden another way by being deliberately left out (e.g. Bennett & LeCompte, 1990). For example, vocational curriculum has failed to acknowledge that places of work frequently have unequal distributions of power and rigid standards for conformity. As a result, practices which reflect racism, sexism, and classism are never critically examined.

Educational Implications: Possibilities

In the early 1900s John Dewey (1916) envisioned a curriculum that he contended possessed "more of the factors conducive to learning than any other method" (p. 309) Rather than developing a narrow curriculum that's intended purpose was to train students for specific trades, he advocated a broad curriculum that would allow students to acquire practical knowledge, apply academic content, and examine values attitudes, and responsibilities through the study of vocations.

The curriculum that is being advocated here expands upon Dewey's conception of a broad curriculum. It is problematized and incorporates social and political dimensions as well as technical dimensions. It also is multidisciplinary, experiential, and promotes critical reflection and action in the Deweyan tradition.

Multidisciplinary

Vocational curriculum at the secondary level should be multidisciplinary because it blurs the boundaries between academic and vocational education as well as the abstract and applied. Recently cognitive scientists have provided empirical evidence to support what Dewey maintained almost over a century ago, students learn more effectively when they see real world applications of academic concepts.

Recent reports (e.g., Commission on the Skills of the American Workforce, 1990; National Assessment of Vocational Education, 1994) and legislation (e.g., Carl D. Perkins Vocational and Applied Technology Education Act of 1990; School to Work

Opportunities Act of 1994) seem to have increased the support of integration of academic and vocational education. Several states (e. g., New York, Ohio, Oklahoma) and organizations (e.g., Center for Occupational Research and Development, National Center for Research in Vocational Education, Southern Regional Education Board) have also made significant contributions to the development of integrated, and in some instances, multidisciplinary curriculum.

While the movement of integrating academic and vocational curriculum seems to be gaining momentum, there is evidence that much of the integrated curriculum is being developed the same way it has historically: as a completed document or a blueprint. Critical pedagogues find such curriculum problematic for several reasons. First, curriculum should be conceived of as a sketch rather than as a finalized blueprint so that it can guide teaching and learning and yet also allow freedom for significant revision. Second, some of the integrated curriculum that is presently being marketed was developed without teacher input, without consideration for the socio-cultural context of students, and without consideration of counter-hedgemonic possibilities. Rather than having "professional" curriculum developers construct a standardized, generic curriculum that controls the teaching of educators and the learning of students, critical theorists advocate a cooperative approach that incorporates input from a heterogeneous community of learners.

The prevalence of such "teacher-proof" curricula suggests that the technocratic model of curriculum is still dominant. However, alternative approaches to curriculum development have emerged. For example, Wirth (1992) described the Rindge School of Technical Arts curriculum as one where students study mechanical arts, as they relate to academic and fine arts. At this "lighthouse" school, curriculum is project based. In one instance, Rindge students studied the community of Cambridge through their own life experiences, artifacts (e.g., photographs, paintings), museums, and interviews with community members. While faculty collaboratively organized activities and planned projects, students were encouraged to direct their own learning experiences. As a result, the curriculum emerged as a cooperative approach that incorporated input from a heterogeneous community of learners.

Other instances as well have been reported where students participated in learning experiences that successfully integrated vocational with liberal education. For example, Stern, Raby, and Dayton (1942) described some California career academies that restructured the schooling day to the extent that boundaries were blurred between English, mathematics, science, social studies and vocational classes. The curriculum they described was in large part project based. For example, one group of students studied the environment in northern California. Not only did the students engage in the work of biologists and botanists in studying the environment, but they also engaged in the work of historians and sociologists in interviewing persons whose lives were significantly impacted by the environment. In this instance the students also engaged in the work of journalists and political activists because they reported what they had learned from loggers, environmentalists, and the natural environment to their community and legislators.

Experiential

Vocational curriculum such as that described in the above examples helps to eliminate the historical dualisms of knowing and doing as well as abstract and applied. While Dewey (1938) advocated an experiential curriculum, he did not limit it to a "hands-on" approach to learning. In fact, he adamantly opposed the practice of having students repeatedly perform manipulative exercises that simulate industrial practices. In his Laboratory School at the University of Chicago, Dewey had students experiment with artisan as well as factory processes to gain a greater understanding of work (Wirth, 1966). Thus while the students became knowledgeable about tools, materials, and technology, they also investigated taken-for-granted assumptions about how work is done and explored possible alternatives of work.

Experiential curriculum then also demands that the interaction among persons (i.e., students, teachers), things (i.e., tools, machinery), and processes be dynamic rather than static. Students still need to be taught traditional practice for a frame of reference, but they also need to be encouraged to explore alternative processes so as to promote creative applications. Cornbleth (1990) and Miller (1985) asserted that, if students are to become makers of meaning, they should construct, reconstruct, and critique knowledge. Therefore, curriculum should not be presented as uncontested knowledge.

Finally, Dewey (1938) envisioned an experiential curriculum that would allow students to bring their life experiences, or history, into the learning process. Hooks (1994) stated that several things must happen for this to occur. First, teachers must genuinely value everyone's history and presence. Second, teachers must recognize that all classroom participants influence the classroom dynamic and should be encouraged to participate. Third, curriculum only becomes meaningful to students when they become members of a learning community supportive of efforts to understand and apply knowledge to the real world.

Promotes Critical Reflection and Action

In the early 1900s Dewey advocated an emancipatory education that would transform schools, work organizations, and the society at large into more participative, democratic cultures. He, and others (i. e., Jane Addams, and Ella Flagg Young, Chicago public schools superintendent), observed the extent of oppression in society and exploitation in the workplace and recognized the radical potential of education taught through the study of occupations (Dewey, 1916, 1977; Kantor, 1988). Contemporary critical pedagogues (e. g., Gregson, 1993, 1994; Lakes, 1991, 1994; Shor, 1988; Simon & Dippo, 1987) have argued that vocational educators should "educate in ways that go against the grain of hierarchical, oppressive workplaces and produce agents of progressive change" (Carnoy & Levin, 1985, p. 16). These critical theorists have maintained that vocational curriculum possesses the potential for uncovering unjust contradictions.

The curriculum being advocated here then, similar to the one envisioned by Dewey (1916), is transformative or emancipatory in nature because it promotes experiences that require students to critically examine worker and employer values, attitudes, and responsibilities. Contemporary critical pedagogues concerned with vocational curriculum have expanded upon Dewey's concept of democratic education by including Freire's (1985) concept of empowerment. Here vocational curriculum would enable students to use their own life experiences to address posed-problems and then develop a plan for action.

Gregson (1994) provided an example of students using their own life experiences to address posed-problems and then developing a plan for action when he described a cosmetology class in the mid-west. When the cosmetology instructor led her students in an examination of how U. S. society perceives beauty, she had her students cut out pictures of models and celebrities they recognized as sex symbols and paste them on poster board. Though a significant percentage of the students were African American, the vast majority of the pictures selected by the students were of white women, more specifically, blond white women. Further, the few African American women that were depicted on the posters, had straight hair and light-skin.

The students that constructed these posters were unaware of this disproportionate emphasis on white women until the teacher brought it to their attention. The instructor related to the students that she perceived this to be a problem because she, and some of them, could never be considered beautiful based upon this narrow perception of beauty. She also pointed out that the students might not have had much variety to choose from to construct their posters since it was her perception that models depicted in advertisements seemed quite similar in their appearance. The students were surprised and interested. To bring to the surface the underlying issues that contributed to this problematic, the cosmetology instructor asked the students to monitor advertisements in respect to how frequent women of color are employed. The instructor also asked the students to determine whether the women of color that were depicted, physically resembled whites.

When the students reached the conclusion that there was a dominant ideology in regards to what constituted beauty, the cosmetology instructor asked the students to identify possible factors that contributed to this phenomenon. The students identified the following factors: (a) commercials and advertisements for beauty products select beautiful models to send the message that if you use their product you will also look like the depicted model, (b) television and movie directors employ actors and actresses they perceive as most attractive to maximize public interest, and (c) most of the major decision makers are white and are ethnocentric in their perception of beauty.

Once the students had identified these factors, the cosmetology instructor wanted to promote incoherence and further problematize the beauty issue. To accomplish this, she confessed that she colored and permed her hair. She also related how important it was for a cosmetologist to look attractive to customers. The instructor then posed the problem: Hair stylists need to look attractive so that customers will perceive them as professional. However, hair stylists need to recognize that beauty encompasses people who look quite different from one another and that they should not promote one limited "look."

In this example the cosmetology instructor had listened to her students and found that many of them were dissatisfied with their appearance. When the teacher led the students into an investigation of beauty, they all reflected on their perceptions and came to the conclusion that they, and the society at large, had a narrow conception of what constituted beauty. Participants in this cosmetology program then developed strategies to change their behavior, and others, based upon their reflections. Specifically the students: (a) displayed a variety of posters depicting models of different ethnicity, (b) conducted an ethnic hair show during African American week, (c) implemented more learning experiences that focused on ethnic hair, (d) requested more mannequins with simulated ethnic hair, and (e) wrote the state board of cosmetology and recommended to this agency that its curriculum and licensing examination reflect more of a multicultural society.

When the students reflected on their actions, they came to the conclusion that they had gained a better understanding of racism. Many students also stated that they learned a lot about themselves -- some of which they did not like. While the cosmetology students frequently commented that it felt good to be an active participant in the learning process, they expressed amazement that they could make personal and social change. In addition, they recognized how, through collective struggle, a group of people could increase their political potency and make the environment more democratic and just.

The above narrative is representative of the approach to curriculum development that is advocated within this paper because it: (a) encouraged student voice, (b) allowed students to relate meanings of work from a critical rather than solely a technical stance, (c) emphasized active student participation through liberatory dialogue, (d) sought to develop the same skills that are required to become an active citizen in a democratic society, and (e) combated social reproduction through incorporating learning experiences essential in the preparation of students for higher status and greater income employment (Gregson, in press; Shor, 1988; Simon, Dippol & Schenkel 1992).

Summary

If we as vocational educators are interested in democratic curriculum reform, there is a need for us to engage in a personal, ethical, and political discourse on the purpose of vocational curriculum. The intent of this paper is to contribute to this discourse and provide insights into the emancipatory or transformative possibilities of vocational curriculum. By providing real world examples of critical curriculum and its development, it is hoped that alternative approaches to curriculum will not be labeled as dreams of "impractical romanticists" as they were in the early 1900s.

While there is evidence to suggest that the technocratic approach to curriculum development may still dominate, there is also evidence that alternative approaches to the development of curriculum are gaining greater recognition. Parents and community members are beginning to insist that vocational curriculum be needs-driven rather than solely industry-driven. To be needs-driven, curriculum should be perceived of as praxis, constructed at sites of learning by teachers and students. This does not negate the need to plan, act, and evaluate curriculum, but rather it acknowledges that learning sites vary considerably from one another and that therefore curriculum should reflect the respective sociocultural contexts of them. When vocational educators embrace curriculum as praxis, communities of learners will learn about work in a holistic manner as well as how to do work.

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Usable Knowledge and Problem-Solving Proficiency in Occupational Training

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Introduction

In many industrial settings work-ers are expected to do more than follow directions; quality circles and self-managed teams require both individual and group problem-solving and decision-making. Bailey, (1990) lists technological change, shorter production runs, and increased emphasis on quality as factors leading to increased responsibilities for the front-line manufacturing workforce. Cohen and Zysman (1987) attribute the success of Japanese manufacturing to the fact that front-line workers there are given broad areas of responsibility rather than assigned specific tasks. In contrast, Berger and others (1989) criticize the lack of training in problem-solving for the American manufacturing work force. Berryman (1993) notes that the traditional conception of a job as a "fixed bundle of tasks and skill requirements" is being replaced by an expectation of sufficient flexibility to meet the demands of a constantly changing work environment (p. 346). Because employers expect front-line workers to be able to analyze a novel situation in order to determine an appropriate response, occupational proficiency must include problem-solving skill in addition to job-specific skills.

The purpose of this paper is to examine individual differences in the ability of participants in an occupational training program to select elements of previously acquired occupational knowledge for use under new conditions. Situations requiring selection of relevant knowledge are likely to occur after the acquisition of basic skills has been completed since the initial stage of occupational training programs usually involves acquisition of indiidual skills performed under predictable sets of conditions. This paper will seek to answer three related questions: Is it possible to identify the concepts that are applied in a problem situation? Can problem-solving skills be identified that are used to classify previously acquired knowledge? Is there a relationship between conceptual knowledge derived from previously encountered situations and proficiency in responding to a problem situation?

Theoretical Background

There is a high level of interest in identifying skills and attitudes that promote the application of occupational skills to new situations. Pratzner (1985) calls for occupational education programs that emphasize "higher-order transferable skills, judgments, and initiative, e.g. problem-solving, decision-making, [and] planning" (p. 9). Fitzgerald (1986) views general skills such as "suspension of closure," "sustained analysis," and "rule application" (p. 274) as the results of practice in the application of occupational skills to new situations, while Miguel (1977) views general skills such as "knowing how to access information," "identifying information needed for a particular task," and "using information" (p. 14) as prerequisites for the application of occupational skills to new situations.

Should the above-mentioned skills can be viewed as characteristics of an individual's general approach to problem situations or as outcomes of problem-solving practice in a specific content domain? Owen and Sweller (1989) argue that the application of knowledge to new situations requires knowledge of principles associated with a particular type of problem structure. On the other hand, Lawson (1990) concludes that "there is encouraging evidence that training in the use of different types of general problem-solving strategies has positive impact"

(p. 406). Mayer (1992), however, argues that "skills learned in one domain can be successfully used mainly in that domain" (p. 365). Glaser (1984) notes that although training programs aimed at improving problem-solving ability attempt to provide general knowledge about how to respond to problem situations, problem-solving proficiency results from the ability to apply a specific body of knowledge to new situations. In other words, the organization of knowledge in a particular content domain will reflect both knowledge of a specific content domain and general characteristics of response to problem situations.

Expert problem-solvers are able to draw upon their knowledge and experience in order to respond to variations of previously encountered situations. Glaser (1985) defines expertise as knowledge which can be reorganized to meet the demands of a particular situation. Similarly, Greeno (1989) views thinking as the reorganization of knowledge to cover new situations through the use of concepts derived from a specific knowledge domain. Glaser (1990) defines the creation of usable knowledge as the "proceduralization" of declarative knowledge, i.e. the combination of factual knowledge into meaningful units. Chi, Glaser, and Rees (1982) noted that experts do not display a greater level of proficiency than novices in general problem-solving ability, but that experts classify problems according to characteristics related to solution procedures while novices classify problems according to surface features.

In a study of the ability to utilize examples, Chi, Bassok, Lewis, Reimann, and Glaser (1987) found that successful problem-solvers made greater use than unsuccessful problem-solvers of techniques involving generalizations. Chi and Bassok (1989) explain the use of generalizations as "an overt manifestation of active processing during learning" (p. 270). On the other hand, less successful problem-solvers used examples for "searching for a template from which they could map the to-be-solved problem so that they could generate a solution" (p. 276). Laurillard (1984) found a similar pattern in the use of self-explanations when solving problems. Successful problem-solvers attempted to understand what they were doing, while less successful problem-solvers preferred to ignore the structure of a problem and to manipulate elements in searching for a solution.

Definition of Variables

Problem-solving Proficiency

Performance in a problem situation is the ability to respond to a situation which is different from those that have been previously encountered. Problem difficulty depends on the degree of difference between problem situation and target situation, a potentially relevant situation in a problem-solver's previous experience. Examples of the lowest level of difficulty, a routine mathematical computation or a familiar repair operation, involve a readily identifiable correspondence between a problem situation and a recently experienced target situation. Examples of the highest level of difficulty, reducing the dropout rate in an inner city high school or designing an energy-efficient automobile, are characterized by the absence of a usable target situation and the necessity of creating one out of fragments of previously experienced situations.

The level of problem-solving skill under investigation in this study falls between the two extremes of difficulty. The availability of a target situation and a generally accepted solution procedure are characteristics of a problem situation below the highest level of difficulty. On the other hand, the selection of a target situation from among several possible variations and the subjects' lack of experience with the process of selection are indications of a problem situation above the lowest level of difficulty.

Usable Knowledge in Problem Situations

Usable knowledge in problem situations consists of the transformation of what has been learned in one set of conditions into knowledge that can be used under other sets of conditions. Glaser (1984) defines "accessible and usable knowledge" (p. 97) as knowledge that can be applied to a specific category of related situations. Similarly, Hatano and Inagaki (1984) contrast conceptual knowledge, the ability to modify principles based on the requirements of a particular situation, and procedural knowledge, the production of defined behaviors under specified conditions. Greeno and Berger (1987; 1990) differentiate between instruction based on general principles and instruction based on procedures, noting that principles can be used to infer procedures, but not the reverse. Schneider (1985) distinguishes between performance based on knowledge of principles which is appropriate for tasks requiring a high level of attention and performance based on knowledge of procedures which is appropriate for tasks performed automatically.

Usable knowledge can be measured through observation of the recognition and representation stages of the response to a problem situation. Problem recognition consists of the initial response to a difficult situation. It involves the problem-solver's tentative identification of a type of situation which will be used as a target situation. Laurillard (1984) contrasted an active approach to representation involving a search for meaning with a passive approach involving an intention to memorize or reproduce. Recognition is followed by representation, the classification of the characteristics of the problem situation according to comparable characteristics of the target situation; the result is a series of procedures that will be followed to obtain a solution. By observing use of worked-out sample problems, Chi and Bassok (1989) and Chi, Bassok, Lewis, Reimann and Glaser (1987) differentiated between active approaches characterized by abstraction of general principles and passive approaches characterized by blind imitation.

Methodology

In order to measure usable knowledge in problem situations the following are necessary: subjects possessing an equivalent body of knowledge, a task requiring application of knowledge, and some means of observing the organization of knowledge that subjects apply to a problem situation. Through observations of a machine tool technology training program, the researcher identified a part that could be produced using several different methods and whose size could be expressed through a variety of combinations of dimensions. A problem scenario was developed requiring the use of a method different from the one commonly used during training programs and providing information through an unfamiliar combination of dimensions. In order to examine the organization of knowledge relevant to the problem scenario, a follow-up interview was developed which contained questions regarding classification of the scenario (problem recognition), requirements for the use of different methods (methodological representation), and the existence of equivalent combinations of dimensions (mathematical representation).

Problem Scenario

The skill selected for use in the scenario was cutting a taper (a cone with the point cut off) on a lathe. Determining an appropriate method for cutting a taper requires taking into account the dimensions of a taper, the size of the lathe, and the availability of a taper-cutting attachment. Trainees had produced tapers using only one method, and the method chosen for the scenario is seldom employed during training programs. However, it is discussed in machining textbooks. The problem scenario consisted of a request to machine a taper under conditions requiring selection of this method. Subjects were asked to go through the planning process they would normally go through prior to the start of actual machining operations. In most training activities, drawings of the desired parts are provided, but the problem scenario presented information in sentence form without using a drawing or diagram.

A cylinder with the length and diameter described in the simulation was mounted on a small lathe on which the taper attachment had been removed. Subjects were given the problem scenario (Appendix A) and asked to decide how the taper should be cut, determine what values would be needed to set up the cut, and describe how they would set up the lathe. They were provided with a calculator and a copy of a chapter on taper cutting from a machining textbook. The chapter contained discussions of the different methods of taper cutting, formulas for calculating the required dimensions, and directions for setting up the lathe. Subjects were allowed to work for as long as they wished. Performance on the simulation was observed by the researcher and recorded using the form "Analysis of Performance on the Taper Problem" (Appendix B). During a preliminary study, several subjects suggested a variation of the desired method not mentioned in the text. This method involved calculations that were more familiar to subjects than those suggested in the text. Consultation with the instructors revealed that this alternative method was justifiable (although possibly more time consuming) and the form used to record performance was revised to allow for an alternative solution path.

During the initial phase of the scenario the researcher noted which method had been selected and whether subjects attempted to diagram the given information. Once a method had been selected, subjects attempted to determine what values they needed and how they could be obtained. For the demonstration of the setup, subjects explained how they would use the values they had obtained to position one or more measuring indicators during adjustment of the lathe. For the standard method, indicator placement was described in the reference material; for the variant method, placement of the indicator had to be determined independently. Success was defined as selection of the correct method, calculation of needed values (according to either the standard or the variant approach), and the appropriate use of those values in setting up the lathe. Partial success was defined as a single identifiable error preventing a successful response. All other responses were classified as unsuccessful. Calculations beyond those necessary were noted, but did not enter into the scoring.

Follow-up Interview

The purpose of the follow-up interview (Appendix C) was to measure the presence of concepts required for the recognition and representation phases of the scenario. The taped interviews were transcribed at the conclusion of the study. A positive answer to each of the three questions was counted as one point for a total learning score between zero and three. Responses were compared with the concepts that were applied by the researcher in the construction of the scenario.

The first question, a request to compare the scenario to previously encountered situations, was intended to establish problem recognition, that is, to determine the existence of the category of situation used to classify the problem scenario. A positive score on this question required a comparison of the scenario to previous taper-cutting experiences. Recognizing taper cutting as a category of situations requires awareness of both similar characteristics for all taper-cutting situations and differences among particular taper-cutting situations.

The second question, a request to discuss the uses of the different methods of cutting tapers, was designed to establish methodological representation, the classification of a problem situation in a category based on common solution procedures. A positive score for this question required recognition of the variables required for determining an appropriate method for cutting a taper and an understanding of how different ranges of values for those variables were associated with a particular method of cutting tapers.

The third question, a request to explain different ways of providing the information needed to describe a taper, was designed to establish mathematical representation, the classification of a problem situation based on a set of mathematical relationships. The expectation for this question was that it involved recognition of the existence of multiple combinations of dimensions capable of providing the minimum information necessary to define a taper. However, most subjects interpreted this question as indicating a request to provide information about the rate of taper only. Therefore, a positive score was given for to responses indicating awareness of multiple means of describing the rate of taper.

Educational and Occupational Background of Subjects

Subjects were eighteen adult students in a self-paced machine tool technology program in southern Michigan. The number of subjects was not sufficient to allow classification of subjects by differences in work experience, educational background, race, or gender. The age of the subjects ranged from twenty-one to fifty; the median age was thirty-two. All of the subjects were high school graduates, and six of the subjects (33.3%) reported having completed two years of college. Twelve subjects (66.7~) reported taking courses in algebra, eight (44.4%) reported having had courses in geometry, eight (44.4%) reported having had trigonometry, and twelve (66.7%) reported technical or shop mathematics. Three subjects (16.7%) reported not taking any of the above-mentioned courses. Ten of the subjects (55.5%) reported at least one year in a skilled position in the machine trades, and an additional five subjects (27.7%) reported at least one year in a semi-skilled position. The remaining subjects reported no manufacturing work experience or only unskilled labor in a manufacturing setting.

Results

Performance on the Problem Scenario

The level of performance of three subjects (16.7%) was successful, that is, characterized by selection of an appropriate method, calculation of necessary values, and use of those values in setting up a lathe. The level of performance of nine of the subjects (50%) was partially successful; their performance was distinguished from successful performance by only a single identifiable error, and the level of performance of six subjects (33.3%) was unsuccessful. The problem scenario can be characterized as difficult for the subjects since only three out of eighteen (16.7%) did not make some type of error.

Selection of Method

Fifteen of the eighteen subjects (83.3%) decided to use the most appropriate method to cut the part. Seven of the subjects (38.8%) either made their own diagrams or referred to diagrams in the reference material. The form of the diagrams was quite varied: rectangles to show the workpiece before cutting, triangles to illustrate taper per foot, and several diagrams for which the purpose was not clear. Only one drawing showed a symmetrical taper (a cone with the point cut off).

Preparation for Setup

Seven subjects (38.8%) attempted to calculate the value needed for setup using formulas obtained from the reference material. Two of them did so correctly, while four subjects who located the correct formula did not use the correct dimensions in the formula. One subject used taper per foot in a formula which called for taper per inch. Ten subjects (55.5%) attempted the calculations needed for implementation of the variant approach. Three of the ten obtained the correct value, while six neglected to transform a value based on the diameter into a value based on the radius. The tenth subject did not use the given information correctly. Two subjects attempted both methods and made errors in both methods. Ten subjects (55.5%) attempted to calculate dimensions that were not needed for the setup. Three were successful, and an additional two calculated one dimension correctly while calculating another one incorrectly.

Demonstration of Setup

Of the twelve subjects (66.7%) classified as successful or partially successful, three demonstrated a method of placing a measuring indicator based on information from the reference material, and seven demonstrated a method of placing a measuring indicator appropriate for the variant method. One subject demonstrated both of these methods. A subject who became confused between the two methods of placing the measuring indicator was the only one whose level of success was affected by the demonstration of the setup. Of the six subjects (33.3%) classified as unsuccessful three were unable to demonstrate any method because they had been unable to calculate any values which could be used for the setup. The other three demonstrated a method of setting up the lathe that was not appropriate.

Results of the Follow-up Interview

Problem Recognition (Question 1)

Subjects were asked to compare the situation faced in the scenario to previously encountered situations. The desired response involved recognition of the basic similarity of taper situations as well as differences based on the method of cutting tapers and providing taper dimensions. Responses that stressed differences on non-essential factors were scored as incorrect. There were no ambiguous responses.

The following is a sample of correct responses:

> "you didn't have to use the offset method which is not used much anymore"; "similar except that we used the taper attachment instead of moving the tailstock."

The following is a sample of incorrect responses

> "the one that we did when we first did the lathe, everything was in the proper place"; "instead of a picture, you use words."

Methodological Representation (Question 2)

Subjects were asked to describe guidelines for the use of the different methods for cutting tapers. The desired response involved mentioning both different methods of cutting tapers and the guidelines for their use. Responses that failed to mention a guideline or mentioned an inappropriate guideline were scored as incorrect. There was one ambiguous response.

The following is a sample of correct responses:

> "if you don't have a taper attachment, offset the tailstock"; "taper attachment would do large tapers, tailstock would do large tapers, compound taper would be [for] small, short taper";

The following is a sample of incorrect responses:

> "depend on the amount of accuracy required"; "I've never really had to cut tapers";

The following is an ambiguous response:

> "what size of a taper you're cutting."

Mathematical Representation (Question 3)

Subjects were asked if there was more than one way to give the dimensions of a taper and to describe alternative means of giving the dimensions of a taper. The desired response involved the recognition that relations between taper dimensions create the possibility of different combinations of dimensions for providing the minimum amount of information needed to define a taper. It was considered acceptable to interpret the question as referring only to alternative ways of expressing the amount of taper. Most of the correct responses simply emphasized alternatives to giving the taper per foot. Incorrect responses contained incorrect mathematical relations between taper dimensions or insisted that there were no alternatives to a particular taper dimension. There were two ambiguous responses. The following is a sample of correct responses:

> "you could work it out without knowing what your tpi is; you could work it out in trig";

> "instead of putting in a taper at all, you could put fore and aft measurements so the person could figure out the taper himself";

The following is a sample of incorrect responses:

> "if you want to use tailstock offset, you need tpf"; "give you the length and you figure out the triangle."

The following are ambiguous responses:

> "small or large diameter, tpi or tpf"; "tpf and length of taper."

Learning Scores

Positive answers to the three follow-up questions were scored at one point each, and ambiguous responses were scored at one-half point. The mean learning score was 1.75; there were substantial numbers of scores at both extremes, four subjects (22.2%) received a learning score of zero and five subjects (27.8%) received the maximum learning score of three. The mean individual learning scores for the three questions in the follow-up interview were .61, .58, and .56 respectively, indicating that the interview questions were of comparable difficulty. T-tests for dependent means between the pairs of learning scores did not show significant differences.

Table 1 shows the correlation matrix for the total learning scores and the three individual learning scores. All of the correlations between total learning scores and individual learning scores are significant at the .01 level. Of the correlations between individual learning scores, only the correlation between problem recognition and mathematical representation is significant at the .01 level. The lack of correlation between methodological representation and the other two learning scores is an indication of differences in the type of knowledge that was applied.

Table 1
Learning Scores Correlation Matrix

	Problem Recognition (Question 1)	Methodological Representation (Question 2)	Mathematical Representation (Question 3)
Total Learning	.81 **	.68 **	.81 **
(Question 1)		.26	.58 **
(Question 2)			.29

** = significant at the .01 level (two-tailed test)

Correlations between Learning Scores and Performance on the Problem Scenario

Table 2 shows both Pearson r and Spearman ρ correlations between performance on the problem scenario and learning scores. The two correlations show the same pattern of statistical significance. Three of the four correlations between learning scores (problem recognition, mathematical representation, and total learning score) and performance on the problem scenario reach the .01 level of significance. The correlation for methodological representation is not significant. These correlations can be explained by the essentially mathematical nature of the problem scenario. Subjects who are proficient in basic algebraic and geometrical operations are more likely to be able to define categories based on geometrical principles and use algebraic operations to respond to variations in those categories than those who are not proficient in these areas.

Table 2
Correlations between Learning Scores and Performance on the Problem Scenario

	Pearson r	Spearman ρ
total learning	.61 **	.57 **
problem recognition	.64 **	.65 **
methodological representation	.13	.16
mathematical representation	.63 **	.63 **

** significant at the .01 level (two-tailed test)

CONCLUSION

This study found sizable differences in the ability of occupational trainees to apply what they have learned to new situations. The new situation represented by a problem scenario presented an application task of moderate difficulty requiring selection, but not creation, of a target situation. The statistically significant relationship between possession of conceptual knowledge and success on the problem scenario indicates that problem-solving proficiency requires the organization of related knowledge. Furthermore, for situations that must be categorized on the basis of mathematical characteristics, mathematical concepts are key elements of the most useful organization of knowledge.

Although it is not clear that general problem-solving skills can be taught, it is likely that problem-solving skills relating to broad categories of problem situations can be taught. In order to improve problem-solving skill, practice with problem situations of moderate difficulty under conditions which encourage the use of problem-solving skills and procedures is necessary. Demonstrating proficiency in a skill under a single set of conditions may not lead to the ability to apply what has been learned in different sets of conditions; instead, this type of proficiency should be seen as a prerequisite for the acquisition of problem-solving skill in a specialized content domain .

The incorporation of problem-solving activities into occupational training has implications for instructional content, design, and delivery methods. With respect to content, situations requiring application of knowledge must be identified. With respect to instructional design, exposure to problem situations must be arranged according to both content prerequisites and level of problem-solving difficulty. With respect to instructional methods, techniques that encourage the use of problem-solving skills in new situations must be utilized. In conclusion, occupational training that incorporates activities involving the broadest possible application of what is being learned will promote the organization of knowledge necessary for problem-solving proficiency.

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Appendix A

Problem Scenario

You are a maintenance machinist for Amalgamated Widgets. The machine shop in your factory is very poorly equipped; your only lathe is a small blue Clausing that is exactly like the one in the machine shop at the RMTC. You have just come in to work and find the following note from the machinist on the last shift:

A little while ago the boss brought in this piece of stock and said there was an urgent need for an 8.65 inch long taper with a taper per foot of .62Z3 inches. I faced the piece off to 10.75 inches, put in the center holes, and measured the diameter (1.023 inches), but I had to leave early because my kid is in the school play. I'm sure you'll be able to finish the job.

Using the above information and this lathe, determine how you would cut the taper and demonstrate how you would set up the lathe.

Please do not consult with anyone while working on this activity. You may refer to the section on tapers from Turning Technology by Krar and Oswald. You may also use a calculator. Please put any calculations you make on this page or on the next page.

(This activity will conclude when you complete the setup; it is not necessary to turn the lathe on or to insert a cutting tool.)

Appendix B

Analysis of Performance on Taper Problem

I. Selection of method

Y N A. The offset method is selected.

Y N B. A diagram is drawn or reference is made to an existing diagram.

Y N C. A decision is made to calculate the offset directly and the correct offset formulas are located in reference material.

or

Y N D. A decision is made to calculate the taper per inch in order to offset the tailstock by trial and error to obtain the needed taper per inch.

II. Preparation for setup

Y N A. The given information is correctly used to set up the equation(s) for obtaining the offset value and the correct offset value is obtained.

or

Y N B. The taper per inch is calculated by dividing taper per foot by 12 and the taper per side was calculated by dividing taper per inch by 2 .

III. Demonstrating the setup

Y N A. With the lathe centers aligned, an indicator is positioned to move **across** the tailstock spindle to measure the correct amount of offset.

or

Y N B. After some way to measure an inch of carriage travel is devised, an indicator is positioned to move along the workpiece to measure the taper per inch. The offset is adjusted to yield the correct amount of taper when the carriage moves an inch.

Appendix C

Follow-up Interview

HOW WOULD YOU COMPARE THIS SITUATION TO THE TAPERS THAT YOU CUT DURING THE LATHE UNIT?

I. Comparison of Simulation and Previously Encountered Situations:

The differences involve method of cutting tapers and dimensioning.

CAN YOU TELL ME WHEN YOU WOULD USE THE DIFFERENT METHODS FOR CUTTINGS TAPERS?

II. Taper Cutting Methods:

Tapers can be cut by the following methods:

taper attachment -- (if available) used for slight tapers up to the length of the taper bar

cross slide -- used for steep tapers up to the amount of travel of the cross slide
offsetting the tailstock -- used for slight tapers up to the amount of offset of the tailstock

CAN YOU TELL ME WHAT DIMENSIONS YOU WOULD NEED TO KNOW IN ORDER TO BE ABLE TO CUT A TAPER? CAN YOU TELL ME MORE THAN ONE WAY TO GIVE THE DIMENSIONS FOR A TAPER?

III. Dimensioning Tapers:

Tapers can be described by the following combinations of dimensions:

length of taper and both diameters
length of taper, one diameter, and rate of taper,
length of the taper, one diameter, and amount of taper
    * both diameters and angle of taper
    * length of the taper, one diameter, and angle of taper
    * trigonometric functions required to obtain missing dimensions

Use of Thinking Skills In a Selected Work Environment

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Perspectives or Theoretical Framework

Thinking skills, including creative thinking, decision making, and problem solving are based in cognitive and metacognitive psychological theories. The America 2000 report (U.S. Department of Education, 1991) and reports of the Secretary's Commission on Achieving Necessary Skills [SCANS] (U.S. Department of Labor, 1991, 1992a, 1992b) have emphasized the need for thinking skill development in the nation. Lambrecht (1992) and Willis (1992) identified three approaches to teaching thinking skills. These are the general, infusion, and immersion, with the infusion approach being the most widely used. This approach requires that thinking skills be taught in context. Therefore, specific, workplace related examples of thinking skill use are needed. Additionally, Bailey (1990, May) concluded that tomorrow's workers will need more extensive thinking skill abilities than today's workers. One workplace setting where Bailey identified thinking skills as being needed was banking. Bennett (1992) emphasized that banks must provide superior customer service to grow and remain profitable. Thus, this study was developed to examine the use of thinking skills in a bank setting.

Objectives

This qualitative study was designed to identify instances when bank employees used thinking skills, including creative thinking, decision making, problem solving, and combinations of these skills in customer service aspects of banking. Further, the study examined how bank employees perceive they acquire thinking skills.

Methods and Data Source

A qualitative design was selected to gather data. Specifically, the behavioral event interview approach was used as this approach has been successfully used in both industrial and educational research (Boyatzis, 1982; Schmidt, Finch, & Faulkner, 1992). The behavioral event approach was selected as the major purpose for using it is to identify the necessary competencies of various jobs (McClelland, 1978). Further, it is designed to gather as many descriptive details as possible in the interviewees' own words. It allows for interviewing a few people in-depth to gain an understanding of thoughts, feelings, and behaviors.

A purposive sample of 27 bank employees were interviewed at nine branches representing three large asset sized banks. At each of the nine branches, a branch manager, new account representative, and teller were interviewed. This sample provided a data base that adequately represented the banking environment since a consistency of responses from the interviewees emerged.

Each interview was tape recorded and then transcribed. The Ethnograph computer program was used to facilitate handling of the large quantities of text generated through the interviews. The printed version of the interviews was reviewed and segments of the text were classified or coded to denote an instance of each thinking skill occurrence. These instances were a segment of an interviewee's response that represented a thinking skill use according to the definitions used for the study. The Ethnograph facilitated grouping the instances into thinking skill categories. Seven possible categories existed. These were creative thinking, decision making, problem solving, creative thinking combined with decision making, creative thinking combined with problem solving, decision making combined with problem solving, and creative thinking and decision making combined with problem solving. The instances comprising each thinking skill were reviewed and recurring themes noted.

Results and Conclusions

The interviewees described 55 events or situations related to their customer service duties where they perceived they used thinking skills. Within these events, 62 instances of thinking skill use were identified. The work environment examined for this study tended to be structured due to the large asset size of the banks selected. Therefore, the interviewees may have been limited in the level of creative thinking, decision making, and problem solving that they could use. The instances of thinking skills relayed by the interviewees ranged from the simple to the complex level. The majority of the thinking skill instances required thinking skill levels somewhere between simple and complex. For example, one manager described a situation where decision making was used. In this instance, a teller had asked the manager for assistance with a customer who was upset because the teller had refused to cash a check. The teller believed the customer was using false identification. Based on observation of the customer and identification information the customer provided, the manager evaluated the situation and decided this was a case of fraud and did not cash the check.

One of the simpler thinking skill instances was classified as creative thinking. The instance was relayed by a teller who recalled performing a task that was not part of the tellers job description. The teller telephoned elderly customers that had not been in the bank recently to determine if they had developed any problems that prohibited their getting to the bank. An example of a complex level thinking skill instance was told by a branch manager. The instance was classified as combining creative thinking, decision making, and problem solving. The manager described how a long-time customer became upset when he was denied a car loan. The manager was able to creatively shift the customers debt level by offering a home equity loan. The manager determined that the customer qualified for this type of loan, with this action solving the problem of an angry customer.

Two interrelated themes emerged from review of the 62 instances of thinking skill use. The first theme involved the generation of new ideas, determining the best alternative, implementing an alternative, or using a combination of these to generate business or sales for the bank. The second theme involved the generation of new ideas, determining the best alternative, implementing an alternative, or using a combination of these to solve a known problem.

None of the interviewees reported having taken coursework that emphasized thinking skill development. Eighteen of the interviewees attributed thinking skill development to experience. Two referred to educational experiences that impacted their thinking skill development. One interviewee described a puzzle that required thought to solve. Five of the interviewees were uncertain how they acquired thinking skills.

Educational Importance of the Study

Bailey (1990, May) referred to a need for tomorrow's workers to possess a greater level of thinking skill development. Specifically, Bailey noted banking employees are no longer limited to opening accounts by gathering information, such as name and address, from customers. Bailey concluded that banking employees must think and sell other products and services to customers. Evidence in support of Bailey's research was found in this study. Interviewees offered instances when they actually carried out the type of activity that Bailey identified as requiring greater levels of thinking skills. For example, a new account representative relayed a story about a customer who came into the bank to open a checking account. While opening the account, the employee uncovered information that led the new account representative to suggest other bank services and products. The suggestions led to a mortgage being written by the bank's mortgage company.

Previous research has suggested that thinking skills are used in work settings. This study provided real-life examples that illustrate thinking skill use in the customer service aspects of banking. Instances of creative thinking, decision making, problem solving, and combinations of these were identified in the events relayed by the interviewees. Further, the Carl D. Perkins Vocational and Applied Technology Education Act (1990) references the need for workers to possess thinking abilities. This study provides substance for this idea by identifying actual workplace instances of thinking skill use.

Based upon the findings of this study, educational focus is needed on thinking skill development. Banking employees believe thinking skills are important to their job. However, thinking skills were not given adequate representation in the employees' education prior to employment. Further, despite the relatively large size of the banks, the employees did not report receiving any company sponsored training designed to develop thinking skills. The interviewees in this study were experienced in their jobs and reported a need to use thinking skills to perform their jobs well. Today's banking environment is customer service oriented, with customer service viewed as critical to a bank's survival. Less room exists for costly mistakes that occur through trial and error development of thinking skills.

Instances of the thinking skill use detailed in this study should be used to build educational materials for the teaching of thinking skills. These instances provide actual workplace examples of thinking skill use that can serve in the infusion method for teaching thinking skills. Lambrecht (1992) and Willis (1992) refer to the popularity and advantages of teaching thinking skills within context. This study provides a base from which to develop thinking skill context for instructional purposes with an emphasis on the two interrelated themes: (a) generating sales and (b) solving known problems. The actual workplace examples of thinking skill use identified in this study add to the psychological base of thinking skill development. They provide real-life situations that can be used as a basis for further study of thinking skill development

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Evolving a Model for Evaluating Tech Prep Implementation

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Introduction

Today's educational structures are facing profound and exciting new challenges. Concern about the United States' ability to compete in world markets has focused attention to the link between education and employment. Increasingly complex technologies are rapidly extending into virtually every aspect of modern life. Students will need to acquire both an understanding of the subjects studied and the capacity to apply what they have learned in the increasingly complex real-world settings they will face as they enter the workforce. Educational systems are searching for ways to promote the integration, application and transfer of learning through mechanisms that are meaningful and motivational to students and that are capable of preparing them for living in an increasingly complex world. Government and educational agencies are responding to this call for reform. Federal and state initiatives have been developed to restructure education including Goals 2000, School-to-Work Opportunities Act, and Tech Prep.that were developed to address these needs and concerns were provided for in the Carl D. Perkins Vocational and Applied Technology and Vocational Education Act of 1990. Tech Prep programs have been designed and structured specifically to forge strong and comprehensive links between secondary and postsecondary educational institutions. Programs within these institutions lead to the completion of an associate degree or two-year certificate; provide technical preparation in a specified field; build student competence in mathematics, science and communications; and lead to placement in employment. Specific program goals set forth in the Act include the development of articulation agreements, a core of required courses, curriculum, in-service teacher and counselor training, equal access for special populations, and preparatory services.

Tech Prep programs include provisions for 2+2, 2+2+2, 4+2, and 4+2+2 configurations. Within these configurations, articulation agreements are developed and implemented between the educational agencies involved. Articulation links two or more educational agencies and enables students to move from one level to the next without delay or duplication of courses. Tech Prep programs also provide secondary students the opportunity to enter directly into the workplace. This is done by developing applied academic and technical course work for students at the secondary level.

Thus it is clear that Tech Prep is comprehensive and ambitious in terms of both goals and scope. There is tremendous potential for spanning the boundaries between vocational and academic education, and making education more efficient and meaningful for students.

But critical questions must be asked, "How are we to know if Tech Prep is fulfilling its promise? What are the essential criteria that should be used to assess Tech Prep outcomes? What evidence is there to suggest that Tech Prep is making a difference?"

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The Tech Prep initiative is emerging from its infancy. Its mission and vision are taking root in concrete form through programs, initiatives, articulation agreements, applied academic courses, and much more. It is becoming increasingly apparent that the time is right to initiate the process of assessing program effects. This is critically important at this juncture to: (a) determine specific program evaluation components of Tech Prep, and (b) to assess the extent to which local Tech Prep implementation efforts are consistent with the mandates of the Vocational Education Act.

Review of the Literature

Program evaluation is necessary to determine if Tech Prep is fulfilling the initial program goals. Program evaluation has been defined as "the application of systematic research methods to the assessment of program design, implementation, and effectiveness" (Chelimsky, 1985, p. 7). Of course the ultimate structure and value of program evaluation must be judged in terms of its ability to assess the pertinent characteristics or dimensions and to result in eventual program improvement.

Tech Prep Program Evaluation

Tech Prep programs should be evaluated to determine if the goals of the program have been attainedattained. Numerous studies have been conducted over the past four years to assess Tech Prep programs (Bragg, Layton, & Hammons, 1994a; Brawer & Hammons, 1993; Delaware Statewide, 1990; Roegge, Wentling, Leach, & Brown, 1993; Rubin, 1993). ile these studies vary in their overall purpose, each was aimed at describing the planning and implementation of local Tech Prep programs.

The basic purposes of Tech Prep program evaluation have been identified as collecting data, providing valuable information to stakeholders, and fulfilling the legislative requirements of the state's accountability system (Dornsife, 1992). The Department of Education and Office of Vocational and Adult Education have provided guidelines for evaluating Tech Prep programs. These guidelines include identifying program characteristics and expected outcomes, anticipating possible outcomes and decisions that may result from the evaluation, identifying information sources, and summarizing and presenting the information (Brustein, 1993).

Increased emphasis was placed on evaluation, planning, and accountability as part of the amended 1976 Vocational Education Act. At the same time, vocational education program evaluation has been a neglected area of research with noted deficiencies in the process (Strickland & Asche, 1987; Wadsdyke, 1978). These deficiencies have included: (a) identifying indicators of the effectiveness of the program, (b) lack of follow-up as to the impact of vocational education programs, and (c) failure to use evaluation as part of program planning, policy setting, and review.

Hoachlander (1991) stated that the new Perkins Act would require the development and implementation of accountability systems that would document the progress of vocational education students and programs. He listed outcome indicators appropriate for accountability to include student achievement test scores, program completion rates, competency gains, and job placement rates.

Following a study by Bragg, Layton, and Hammons (1994b) it was recommended that evaluation of Tech Prep programs be conducted to ensure the continued federal support of the Tech Prep initiatives. In addition, seventeen student outcomes were identified incorporating academic skill attainment, employability skill attainment, and matriculation from high school to college.

Outcome Indicators

Limited research has been conducted to identify specific outcome indicators for Tech Prep programs. An outcome indicator is used to determine the program quality, effectiveness, and goal attainment. A summary of four studies conducted to identify outcome indicators for Tech Prep programs is provided in Table 1.

Table 1: Outcome Indicators for Tech Prep Programs

Author(s)	Purpose of Study	Outcome Indicators
Dornsife	To establish baseline records, establish outcomes, and modify Tech Prep Programs. Identify focus component areas and group the performance indicators to determine the level of performance.	Percent of course enrollment Program competition Job placement Number of articulated classes Number of articulation agreements Marketing activities Staff development Advisement of students Student tracking
Hammons	Identify focus component areas and group the performance indicators to determine the level of performance.	Student retention Grade point average Demonstration of job competency Faculty professional development Guidance programs Access to special populations Academic and vocational skill attainment Level of satisfaction with the program Job Placement Employment levels Earning levels Quality and quantity of resources
Bragg & Layton	Determine the status of Tech Prep planning and implementation in the fifty states and District of Columbia.	Academic skills Secondary program completion rate Job placement rate Technical skills Postsecondary program completion rate Career awareness Employer satisfaction Problem-solving and critical thinking skills Attitudes toward or perceptions of technical careers Student self-esteem
Roegge, Wentling, Leach, & Brown	To develop a conceptual framework for Tech Prep based on the perceptions of personnel involved in planning and implementation of local Tech Prep programs.	Benefits Populations served Outcomes Program components Enrollment incentives External involvement Planning and support Staff development Articulation and integration

Dornsife (1992) identified the outcome indicators that postsecondary institutions would collect for program accountability. Those indicators include percentage of course enrollment, program completion, job placement, number of articulated classes and agreements, marketing activities, staff development, advising, and student tracking.

Hammons (1992) identified six focus areas or components into which outcome indicators could be grouped. The "student" focus component indicators include student retention, grade point average, and demonstration of job competency. The "facilitator" focus component includes faculty professional development, guidance programs, and access to special populations. The "professional development" focus component relates to obtaining information related to academic and vocational skills attainment and advanced courses taken. The "attitudes/perceptions" focus component includes recognition and level of satisfaction with the program. The "careers" focus component evaluates job placement, employment levels, and earning levels. The final focus component, "resources," identifies the quality and quantity of resources utilized.

A study conducted by Bragg and Layton (1992) collected data related to Tech Prep philosophies and policies, staffing, administrative structure, evaluation, marketing, and staff development. A list of outcomes was presented to the respondents to ascertain if the outcomes had been included in their state's list of outcomes. 'These outcomes included improved: (a) academic skills, (b) secondary program completion rate, (c) job placement rate, (d) technical skills, (e) postsecondary program completion rate, (f) career awareness, (g) employer satisfaction, (h) problem-solving and critical thinking skills, (i) attitudes toward or perceptions of technical careers, and (j) student self-esteem. It was reported by Bragg and Layton that "since fewer than forty percent of the states have established outcomes at the state level, a major concern for all leaders at all levels should be the identification of expected outcomes and evaluation procedures" (p. 4-17).

A recent study by Roegge, Wentling, Leach, and Brown (1993) found that using the concept mapping process assisted with displaying the major components for Tech Prep programs. They identified the relationships between the components and priorities placed on each component and cluster of related components. The concept mapping process provided a pictorial representation of Tech Prep stakeholder's perceptions. Clusters identified included benefits, populations served, outcomes, program components, enrollment incentives, external involvement, planning and support, staff development, and articulation/ integration.

Evaluation Models

Several evaluation theorists have proposed varying types of evaluation models that can be considered for use or modification to assess Tech Prep. Regardless of the type of evaluation used, each produces knowledge that was not previously available. House (1983) has distinguished between the various models based on the various assumptions brought to the process.

Scrivens' (1983) Goal-Free model is primarily concerned with reducing the effects of bias in evaluations. The purpose is to establish and justify the merit or worth of a program. The Transaction model proposed by Stake (1983) concentrates on the educational process. This model utilizes various methods of inquiry to determine what the program looks like to different people. Stufflebeam's (1983) CIPP (Context, Input, Process, Product) model evaluates whether the program is effective, and if so, what program components are effective. Its overall purpose is to provide relevant information to decision-makers.

Stufflebeam's model views evaluation as a tool to help make programs work better for the people they are intended to serve. "The CIPP model is based on the view that the most important purpose of evaluation is not to prove but to improve" (Stufflebeam, 1983, p. 118). Identification of outcome indicators will assist in determining a program's overall quality, effectiveness and if the goals were attained. However, inherent in Stufflebeam's model is the notion that these "more ultimate" outcome characteristics are a function of a complex configuration of context, inputs, and process.

Stufflebeam's model involves four important and interactive dimensions - Context, Input, Process, and Product. Context evaluation, as the term implies, focuses on factors comprising the larger "environment" of a program (including community and institutional values, key constituencies, other reforms and change agents, etc.). Context assessment is designed to identify and explore these aspects with particular concern for how those contextual factors influence and interact with the more "program specific" aspects of an implementation initiative. The decisions to be addressed by context evaluation include "deciding upon the setting to be served, the general goals to be sought, and the specific objectives to be achieved" (Worthen & Sanders, 1973, p. 136). The results of context evaluation should provide a sound basis for adjusting an initiative's existing goals and priorities and targeting needed changes.

Input evaluation focuses specifically on the resources which are injected into and directed toward an effort. It is designed to assess the degree to which those resources are appropriate and adequate as well as how they drive and fuel the process, and ultimately deliver the desired outcomes. According to Worthen and Sanders (1973) "methods for input evaluation are lacking in education" (p. 137). Input evaluation provides information for achieving program goals, what strategy to employ, and what design or procedural plan should be employed for implementing the selected strategy. Input evaluation seeks to address the Tech Prep program goals involving: (a) articulation agreements, (b) core of required courses, (c) curriculum development, (d) inservice teacher training, (e) in-service counselor training, (f). access special populations, and (g) preparatory services.

The process component is at the heart of any program's delivery system. It includes the mechanisms and structures that are specifically designed to translate the input resources into desired outcomes. The main use of process evaluation is to obtain feedback to assist decision- makers in carrying out the program plans or to modify the processes as needed. A series of data collection activities is critical with process evaluation. Process evaluation provides the decision-makers with information needed for anticipating and overcoming difficulties, making decisions, and interpreting program outcomes.

Product evaluation is designed to focus the question of the degree to which a program's structure, given a certain "context" and "inputs" has successfully delivered on the program goals. The data collected ideally come from a variety of sources and individuals and should be evaluated to judge the success or failure of the program component in meeting the program goals. Reporting of product evaluation may occur at various stages of the Tech Prep program. Product evaluation is an essential component of the accountability report and provides significant data when seeking additional funding

A Proposed Model

The literature contains several studies conducted to identify outcomes for conducting a program evaluation. No model was found that specifically identified Tech Prep program components and outcomes. Due to the comprehensive score and systemic nature of the Tech Prep concept, Stufflebeam's CIPP model (Content, Input, Process, and Product) was selected and adapted for evaluating Tech Prep programs (see Figure 1).

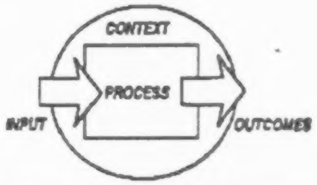

Figure 1. Modified CIPP Model for Assessing Tech Prep Implementation

While the Stufflebeam program evaluation model is inherently comprehensive and well suited for dynamic and systemic programs, additional information specific to each of the four major dimensions must be identified. This information is presented in Table 2.

The assessment model designed for evaluating Tech Prep programs includes Context, Input, Process and Outcomes. The context is framed by the federal and state initiatives to improve education that includes Goals 2000, School-to-Work Opportunities Act, and Carl D. Perkins reauthorization. As part of the Carl D. Perkins Vocational and Applied Technology Act of 1990, Tech Prep is viewed as a concept versus a program. Several states have passed legislation related to other school reform issues. Also included as a part of context is the stage of Tech Prep implementation. Dornsife (1992) has specified these as beginning, intermediate or advanced stages.

Inputs to the Tech Prep assessment model may include state or local consortium specific information to include but not limited to objectives for Tech Prep implementation, adminstrative structure, and funding. In addition, asking the question "who is the Tech Prep student" becomes part of the program planning and decision making process. These elements include: (a) articulation, (b) faculty and professional development, (c) curriculum development, (d) marketing efforts, and (e) guidance and counseling services.

The process involves gathering information from advisory committees, teachers, committee and professional meetings, cooperating schools within the Tech Prep consortium, integrated teams, recruitment materials, and career clusters. The outcomes are the specific indicators obtained to determine the Tech Prep's overall quality and if goals were attained.

Purpose of the Study

Three years into the development of Tech Prep programs, there is a need to describe the current evaluation efforts of Tech Prep and the overall progress of the initiatives. The primary purpose of this study was to develop a program assessment model for evaluating Tech Prep programs. To accomplish this, the following objectives were formulated:

1. To identify existing program evaluation models that support Tech Prep evaluation.

2. To determine the evaluation criteria to include when evaluating Tech Prep programs.

3. To determine the program components to include when evaluating Tech Prep programs.

4. To determine the outcome indicators to include when evaluating Tech Prep programs.

5. To identify the processes used to collect evaluation information.

Methodology

Two primary approaches were used to explore the usefulness of the model that was evolved from the review of the literature. The first approach was to conduct a national survey of those responsible for statewide Tech Prep leadership and reporting. The purpose of the survey was to gather data along the four dimensions of the proposed assessment model (Context, Input, Process and Outcomes). More specifically, information was necessary to (a) assess the availability of data and (b) to further explore the feasibility, features, and robustness of the model. This information was also deemed essential because it impacts the potential utility of an assessment model. The data that were collected during this phase are presented in the "National Survey Finding" section.

The second approach that was used in the study was to pilot test a structured interview instrument that was developed to explore the process aspects of Tech Prep implementation. During this phase, the focus shifted to the process component of the model (specifically examining areas such as articulation procedures, staff development, marketing efforts, etc.) The pilot test was conducted with a consensus sample consisting of all Tech Prep coordinators (12) in one state, Missouri. These coordinators were interviewed, the results were recorded and then synthesized by assessment category. The results of this synthesis are presented in the "Pilot Test Interview Findings" section.

Program Outcomes Assessment - National Survey Findings

To obtain information about the nature of criteria used for the assessment of Tech Prep implementation efforts across the nation, State Tech Prep Coordinators (including Washington, DC and Puerto Rico) were contacted by mail and asked to complete a survey. The coordinators were also asked for information concentrating on the criteria and procedures used to conduct their statewide Tech Prep assessment procedures as well as for information on how Tech Prep students are identified. The initial mailing yielded 15 returns (28.8%). A follow-up survey including a second copy of the instrument was mailed to non-respondents approximately one month after the initial return deadline. This yielded an additional 20 returns for a total of 35 (see Table 3).

The survey began by requesting information regarding the general structure of each of the state's Tech Prep program assessment procedures. Specifically, the respondents were asked whether their state "currently has an evaluation plan in place to evaluate [their] Tech Prep efforts?" Over three-fourths of those responding indicated that such a plan is in place (see Table 4).

Table 2: Tech Prep Components for each Program Assessment Dimension

Context Components

- Tech Prep as a "concept" instead of a "program"
- Federal and state initiatives to improve education (Goals 2000, School-to-Work, Perkins and Perkins reauthorization)
- Oregon, Kentucky, Wisconsin, Missouri and other states have passed legislation related to school reform.
- Continued thrust for accountability and restructuring education
- Coalitions for restructuring (SREB, Coalition of Essential Schools, National Alliance for Restructuring)
- Stage of Implementation (beginning, intermediate, or advanced)

Input Components

- Unit (state or local)
- Objectives for Tech Prep implementation
- Administrative structure
- Funding
- Community attitudes and resources
- School system attitudes, resources, and expertise

Student Identification (who is a Tech Prep student?)

Program Element Inputs

- Articulation experience
- Faculty professional development structures
- Existing curriculum
- Marketing mechanisms
- Guidance procedures and staffing

Process Components

- Advisory council interaction and input
- Teacher team interactions (integration and planning)
- Meetings related to Tech Prep implementation (teachers, counselors, administration, employers, parents, students, etc.)
- Cooperating school agreements and interaction
- Budget processes
- Curriculum development
- Integration process teams
- Career path selection and development

Table 2::(Continued) Tech Prep Components for each Program Assessment Dimension

Outcome Components

- Percent of course enrollment
- Program completion - secondary
- Program completion - postsecondary
- Secondary enrollment postsecondary (career path) program
- Secondary completed postsecondary (career path) program
- Job placement rate
- Earning levels
- Employer satisfaction
- Number of articulated classes
- Number of articulation agreements
- Marketing activities
- Advisement of students
- Career development activities
- Career clusters/pathways
- Access to special populations
- Student retention
- Grade point average
- Demonstration of job competency
- Degree of satisfaction with the program
- Academic skill attainment
- Vocational skill attainment
- Problem-solving and critical thinking skills
- Attitudes toward or perceptions of technical careers
- Student self-esteem

Table 3: Survey Response Rate

	Number of Returns	Return Percentage
Initial Return	15	28.8%
Returns from Second Mailing	20	38.5%
Total Returns	35	67.3%

Table 4: State Plan to Evaluate Tech Prep

	Frequency	Percentage
Have an evaluation program in place	27	77.1%
Do not have a program in place	7	20.0%
The program is in draft form	0	0.0%
No response	1	2.9%

N = 35

To probe the nature of the state evaluation plans, respondents were also asked to indicate which components of the Tech Prep program are included in their state's assessment procedures. Six components were listed on the survey (see Table 5). The responses indicate a pattern of assessment across multiple components rather than focused on any single dimension. Respondents were also encouraged to list any additional components that may be included in their state's evaluation plan. The limited responses were restricted to two components, i.e., business and industry involvement/apprenticeship opportunities and administration and organization.

The focus then shifted to one of the key input elements in the assessment model that is being proposed in this study; the ability to determine the degree to which Tech Prep programs affect students along several dimensions including achievement, drop out, placement, etc. To assess this aspect of Tech Prep implementation, it would be extremely useful to be able to identify and distinguish between students who are in Tech Prep from those students who are not. Thus, the initial question on the survey asked whether the state's consortia "can identify who is and who is not a Tech Prep student." Approximately two-thirds of the state coordinators who responded to the survey indicated that their state was able to identify a Tech Prep student (see Table 6).

Table 5: Components of Tech Prep Evaluation

	Frequency	Percentage
Articulation	22	63%
Student Program Planning	15	43%
Staff Development	21	60%
Curriculum	18	51%
Marketing	16	46%
Evaluation	15	43%
Other	5	14.3%

N=35

Table 6: Ability to Identify Tech Prep Students

	Frequency	Percentage
Can identify Tech Prep students	24	68.6%
Cannot identify Tech Prep students	10	28.6%
No Response	1	2.8%

N = 35

In order to explore these responses in more depth, those who indicated an ability to identify Tech Prep students were then asked to indicate specifically "how" those students were identified in their state. The most frequent and most formalized responses indicated that Tech Prep students were those who are enrolled in courses:

(a) generally oriented toward an occupational path or career direction, or

(b) sequenced and articulated toward post-secondary technical training and/or certification. (These types of responses typically identified the articulation of math, science, communications, and technologically oriented courses.)

These types of rather formalized and consistent responses were provided by less than one-half (10-11) of those who had indicated that they are able to identify Tech Prep students. Additionally, these types of responses were typically accompanied by specific, statewide documentation that usually contained a definition of Tech Prep students.

Input from the remaining 50% of the sample who had responded favorably to the Tech Prep student identification question were more diverse and much less specific. In some cases, supporting documentation defined Tech Prep "programs" rather than Tech Prep "students." Others indicated that identification was either on a student self selected basis or that individual schools were free to designate based on their own criteria.

In the aggregate, the survey indicates considerable disparity across the nation in terms of the degree of formal identification of students participating in Tech Prep programs. Less than one half of those responding (or approximately one state in five) appear to have formalized and clearly documented a mechanism for identifying Tech Prep students. The results also indicate that many states either (a) do not have a mechanism for identifying these students or (b) are not using specific definitions or criteria to identify Tech Prep students.

As a follow-up to those who had indicated that they were not able to identify specific Tech Prep students, respondents were asked whether they "intend to include student progress as part of evaluation" and if so, how they plan to accomplish the assessment. One half of the respondents indicated that they plan to do so (see Table 7).

Table 7: Tech Prep Student Non-identifiers Intending to Use Student Progress in Program Evaluation

	Frequency	Percentage
Intend to use student progress as part of the program evaluation	5	50.0%
Do not Intend to use student progress as part of the program evaluation	2	20.0%
No Response	3	30.0%

N = 10

The responses of those indicating that they plan to use student progress information in spite of a lack of identification of Tech Prep students were examined for substance and patterns. The responses were quite non-specific in nature, referring generally to such strategies as "visiting with students," "performance base instruction," "performance reports," and "placement exams." None of the respondents indicated the mechanism by which students would be selected to participate.

Next, the focus shifted from general assessment planning to the criteria used to assess Tech Prep student progress. From a program assessment point of view, this poses a dilemma. Criterion based assessment of student progress presumes an ability to identify and track changes in students along the identified criteria. As has been indicated above, it is apparent that many states lack a mechanism for identifying Tech Prep students. Thus, the application of criterion referenced assessment procedures to individual students is not possible in these states. In the absence of procedures for identifying program participants, the same criteria may be applied generally across a selected sample of students (an entire school, a school system, certain grade levels, etc.). In this instance, however, the ability of assessment procedures to attribute changes in students (along the selected criteria) to the intervention of the program (in this case Tech Prep) is extremely limited.

In light of this important caveat, the results of those who indicated a lack of procedures for identifying specific Tech Prep students were examined (N=10). Six of the "non-identification" respondents indicated that they are using some of the criteria for evaluating student progress. The criteria that are being applied in these states were distributed across the range of assessment criteria (see Table 8). A similar pattern was observed for states indicating an ability to identify Tech Prep students. However, in addition to the use of multiple assessment criteria, respondents from these "identifier" states also indicate that they are employing specific criteria to assess student progress at a higher percentage. In addition to the criteria that were provided on the survey, some additional criteria were suggested including graduation from college and adherence to a career plan.

It is important to note that a pattern of using multiple criteria to assess students was clearly present across the entire sample (see Table 9). Nearly 70% indicated that they are using more than one criterion and almost one half are using as many as five criteria. This use of multiple criteria provides a means of triangulating results that is an important feature of the proposed program assessment model.

Table 8: Evaluation Criteria Used to Assess Tech Prep Student Progress

	Specific Tech Prep Students Not Identified		Specific Tech Prep Students Identified	
	Frequency of "non identifiers"	Percentage of "non identifiers"	Frequency of "identifiers"	Percentage of "identifiers"
Drop out rate	3	30%	16	64%
Graduation rate	3	30%	18	72%
Test scores	1	10%	15	60%
Pursue post-secondary education	4	40%	19	76%
Job placement	2	20%	19	76%
Grades	0	0%	12	48%
Other	1	10%	5	25%

- N for states indicating a lack of procedures for identifying specific Tech Prep students = 10
- N for states indicating procedures for identifying specific Tech Prep students = 25
- Total N = 35

Table 9: Multiple Criteria Used to Assess Tech Prep Student Progress

Number of Criteria Used	Frequency	Percentage
7	7	20.0%
6	6	17.1%
5	4	11.5%
4	2	5.7%
3	3	8.6%
2	2	5.7%
1	6	17.1%
0	5	14.3%

N=35

One of the important aspects of any assessment model or procedure has to do with the methods and instruments that are employed to gather data. This study found that on site interviews are the method of choice for Tech Prep program assessment data collection. Substantial use was also made of surveys, telephone interviews, and third party evaluators (see Table 10).

Table 10: Data Gathering Mechanisms

	Frequency	Percentage
On site Interviews	22	63%
Surveys	13	37%
Telephone Interviews	10	29%
Third Party Evaluation	12	34%
Other	20	57%

N=35

As was the case with student assessment criteria, there is a clear preference for using multiple procedures for gathering program assessment data. Over one half of those responding indicated that they are using multiple data collection procedures and one-third are using three or more. Again, this indicates a clear preference for triangulation rather than depending on a single mechanism (see Table 11).

Table 11: Use of Multiple Methods for Data Collection

Number ofMethods Used	Frequency	Percentage
5	2	5.7%
4	7	20.0%
3	3	8.6%
2	8	22.8%
1	14	40.0%
0	1	2.9%

N=35

Program Process Assessment - Pilot Test Interview Findings

The previous section described a data collection procedure that was designed to focus the feasibility, nature, and usefulness of the proposed assessment model. The focus now shifts to a set of structured interviews that were conducted to explore the contextual input and process components of the model. To explore these aspects of the model, a structured interview pilot testing process was developed and used to explore the processes that are being used to implement Tech Prep. The process oriented categories that were explored were adapted from those developed by Dutton (1993). These categories included: (a) articulation and collaboration, (b) student program planning and implementation, (c) staff development, (d) curriculum development, and (e) marketing efforts.

The pilot test was conducted on a consensus sample consisting of all Tech Prep coordinators (12) in one state, Missouri. This section is designed to provide a brief synthesis of the findings obtained from this phase of the study well as some additional, general observations and patterns that emerged through the interviewing process.

Articulation and Collaboration.

This component examined articulation structures (e.g., 2 + 2, 2 + 2 + 2, etc.) as well as mechanisms used to facilitate collaboration with business and industry, counselors, vocational, and academic faculty. The findings indicated that these structures are in the initial stages of development. Various configurations of vocational and academic educators, counselors, administrators, and parents have been attending workshops designed to provide information and to establish working articulation agreements. The general level of interest in and support of the Tech Prep concept has been quite high. The most frequently reported challenges to the development of these alliances and agreements had to do with (a) changing attitudes (of academic teachers, administrators, counselors, etc.), and (b) the mechanics of articulating between programs with non-parallel curriculums, for example a secondary level residential wiring program with a post-secondary electronics program.

Student Program Planning and Implementation.

This section focused on the program planning and structuring processes. While planning is in the initial stages, clearly the most frequently used approach is the use of the career clusters. The most frequently identified clusters were agriculture, business and office, marketing, engineering technology, health and human services, and mechanical and industrial trades. The majority of the consortia indicate that their base line 2 + 2 programs will be grounded in career cluster curriculum structures that are beginning as early as grade 8.

Staff Development.

The staff development component focuses on whether there was a plan that outlined and provided staff development activities for all Tech Prep facilitators, including administrators, counselors, and academic and vocational faculty. Specific types of staff development activities that were provided during the past calendar year as well as possible activities planned for the upcoming year were identified. The most frequently used mechanisms consisted of workshops, informational meetings, Tech Prep conference attendance, and on site visits. The sense that was conveyed through the conversations was that many of these interactions are at the preliminary information dissemination stage, designed to provide general orientation rather than in-depth training.

Curriculum Development.

This focus component was designed to assess the degree to which vocational and academic teachers are working together to coordinate and integrate academic and occupational education. In what ways have faculty integrated the mathematics, science, communications, and technology competencies into their curriculum to support the workplace readiness skills? Tech Prep consortium directors were asked if any career clusters have been developed thus far to assist students in completing a four-year educational plan.

Three general observations can be made based on the interviews. First some concern was expressed over limited budgets to purchase curriculum materials. This was particularly significant since most of the consortia also indicated that they are using commercially developed curriculum (CORD, AIT, and PACE). A second thread was that applied academics tended to be a stand-alone course for mathematics, whereas language arts, physics, and biology units tended to be integrated or infused into other academic courses. Finally, most coordinators indicated that they are promoting and using team teaching as a mechanism for delivering integrated academic content and activities.

Marketing Efforts.

A marketing focus category was included to identify the methods that are being used to promote the 2 + 2 Tech Prep concept, articulation, and the sequence of courses chosen within a vocational interest including the work in math, science, communications, and technology. The interview also focused on the overall perception of businesses, parents, students and education facilitators regarding the promotion and marketing efforts utilized thus far? Respondents were also asked to identify the methods that are being used by counselors to enroll students in Tech Prep. An important corollary purpose had to do with the degree to which counselors have an understanding of Tech Prep.

The findings indicated that a variety of tools and techniques are being employed for the general purposes of informing the public at large as well as to recruit students and educate public school personnel. These tools include the dissemination of information packets, posters, folders, videos, mugs, notepads, plaques, etc. Feedback indicated that while there has been considerable activity in this area, that it is too early to assess adequately the effectiveness of the promotional efforts, specially related to specific target audiences.

Summary Observations.

The discussion will now turn to a general summary of impressions obtained throughout the interviewing process. There was a clear sense across all the interviews that the Tech Prep initiative is promoting systemic change. This was communicated through two different types of perspectives. First, there was a strong sense of association with the broader range of educational reform that is occurring in Missouri (where major legislative action has spawned reform) and across the nation (Goals 2000, SCANS, etc.). Simply put, most see Tech Prep as a component in the larger context of educational reform. The second perspective related to systemic change was more local; namely that Tech Prep is leading to some fundamental rethinking of and restructuring of their local educational systems. Specific comments in this regard focused on changing configurations in how academic and vocational teachers interact, developing structures for increased integration and applications of academic content, elimination of the general track, changing the attitudes of parents, counselors, administrators, etc., toward the purpose of schooling and how content is delivered. Bottom line, there was a strong sense that their Tech Prep involvement is part of a larger, systemic educational reform movement.

A second general observation had to do with curriculum development. The sense that emerged from the interviews was that this is an area that needs serious attention. Across the consortia, the clear tendency has been to latch on to existing materials rather than to develop and customize materials at the local level. While many of these materials are of excellent quality, they, in many instances, fail to address the unique directions and configurations that are evolving out of the state's new curriculum standards and curriculum frameworks. Also, some of the materials have been better received by vocational teachers than by traditional academic teachers. The strong sense was that additional work needs to be invested in assisting teachers in the process of learning how to collaborate successfully with one another in the curriculum development and integration processes.

A final observation concerns the identification of Tech Prep students. This thread ran throughout the categories that were identified for analysis. For example, it was felt that marketing efforts would be greatly enhanced if the "target" was more clearly identified. If, on the other hand, Tech Prep is perceived as a kind of general program philosophy that somehow affects the entire school system (as opposed to specific students in specific ways within the system), then marketing is much more difficult. In short, it is one thing to market a general philosophy or structural change. It is quite another thing to recruit specific, individual students into classes that have been designated as part of Tech Prep. The same concern was raised when the conversation turned to program and student assessment as well as, to some degree, curriculum development. Coordinators were somewhat perplexed as to how procedures would be developed to align curriculum and then assess outcomes in the absence of specifically identified Tech Prep students. The overall sense was that Tech Prep student identification may be a critical key to forcing more general systemic change.

Discussion

Given the complex and multi-dimensional nature of the Tech Prep initiative, it is critical that a program assessment model be developed which is also multi-dimensional and capable of assessing systemic change. Within vocational education, there is a long history of focusing primarily on outcomes. Certainly this emphasis must be retained within any viable assessment model. Some of the outcomes are specific to the legislation such as including reduction of drop out rates, successful articulation of students into post-secondary level technical programs, etc. Still others are more specific to individual state and local settings. These program outcomes must be specified in advance if program effect is to be effectively assessed.

It should also be clear that successful Tech Prep assessment must involve more than the assessment of outcomes. Tech Prep outcomes are also a function of certain contextual, input, and process components. The most concrete example of this point from this study is that an absence of specific Tech Prep student identification (an input variable) leads to ambiguity in the assessment of many processes and outcome variables.

This study also illustrates and emphasizes the value and importance of assessing the processes involved in Tech Prep implementation. An exclusive focus on outcomes fails to capture the essence of the interventions that resulted in those outcomes. It is obvious that a major impetus driving the conceptualization of Tech Prep had to do with deficiencies in outcome indicators (school drop out rates, lack of knowledge transfer and application, poor program articulation, etc.). It should also be clear that a major thrust of Tech Prep has to do with developing and implementing processes for restructuring schools and instituting fundamental changes in the way that education is delivered in America. Thus, any valid program assessment model must necessarily include a mechanism for examining "process." As a result of this pilot study, it is recommended that the assessment of the process component include such factors as the quality of integration team interaction; curriculum development and alignment; career path development; advisory council selection, input and interaction; cooperating school agreements; and budgeting. It should also be clear that certain aspects of these process components could also be included in the input component of the model.

It is also important to comment on the nature of Tech Prep structure. Tech Prep is designed to provide broad guidelines within which state and local agencies can work to develop mechanisms that work for them. Tech Prep provides the general structure and the broad guidelines. Local agencies are then free to configure and develop their programs in light of their unique circumstances, needs, goals, and resources. Thus, Tech Prep program implementation inherently tends to be flexible, creative, and localized. This poses unique challenges for program evaluation. Certainly, it is much easier to assess the effects of programs that are homogeneous and for which the boundaries are clearly structured, administered, and maintained. Such is not the case for Tech Prep, nor should it be. Thus, Tech Prep program assessment must consist of a process that uses multiple data collection mechanisms, that includes a diversity of criteria, and that is sensitive to both outcomes and processes as they function within the larger cultural and educational contexts given certain system inputs. The model that is proposed and pilot tested in this study is ideally suited for these purposes.

Given the systemic nature of the Tech Prep initiative, particularly when considered within the larger context of educational reform, it is important that all four of the assessment dimensions be included throughout the planning, implementation, and assessment phases. In order for programs to be assessed systematically and meaningfully, advanced consideration of how context, input, and process components interact and, most important, how (and indeed if) they will be assessed is absolutely critical. An illustration that emerged from this study is that outcomes assessment is, in many cases, impaired by the inability to identify specific input variables (i.e., who is a Tech Prep student).

Thus, while Tech Prep is indeed a concept which is being implemented in many diverse and unique ways, it nevertheless does take on specific programmatic forms at the local level. Tech Prep as "concept" must be translated into Tech Prep as "program." As this occurs, it is critical to subsequent program planning and assessment that the Context, Inputs, Processes and Outcomes which are specific to the local programs be clearly identified and defined. Specific assessment components within each of the four assessment dimensions of the model must be selected for implementation based on the unique characteristics of local consortia. It is perhaps even more important throughout these developmental stages that the question be raised and addressed, "Can and how will this aspect of the program be assessed?" This approach to Tech Prep assessment will assure that the assessment program is comprehensive and robust enough to detect systemic change and yet that it is specific enough to demonstrate accountability, Such an effort must be directed at establishing baseline data against which subsequent movement can be measured. Given the complexity and variety of Tech Prep programs, it is critical that multiple means be used to conduct program assessment. This is necessary in order to triangulate and interpret data as well as to capture the uniqueness of various local configurations.

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On Becoming Reflective Vocational Educators: An Inductive Case Study

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This research grew from a concern that college teaching often does not empower graduate learners to use their acquired knowledge to solve professional problems. In recent years we have used a theoretical framework that we believe encourages collaborative learning and teaching. The traditional power relationship that too often exists between professors and students has been seriously questioned in this research. We have found that the view of "professor as a dispenser of knowledge" is much too confining and potentially exclusionary. Therefore, in recent classes, course members have been invited to become a full member of a community of scholars enjoying the excitement and freedom that can result from the collaborative construction of new and meaningful knowledge (Brooks & Brooks, 1993). Because of this developing perspective, students are now addressed and treated as colleagues, learners, and collaborative researchers. This research resulted from the collaboration of 14 graduate learners who participated in a course whose goal was to empower learners to use organizational theory to change and improve performance of personnel. We explored this information through extensive use of articulation and reflection learning and teaching techniques. These are important elements of cognitive apprenticeships and are based on the research of Brown, Collins, and Duguid (1989), Lave (1988), and Schell and Rojewski (1993).

Organizational change was a unifying theme for the course. Learners were encouraged to think critically and creatively about their role(s) in their organizations and to use new knowledge to understand and solve problems in the workplace. A group project/simulation, based on situated cognition theory, was included. The simulation was entitled Changing Educational Organizations (CEO). To complete the CEO simulation, learners collaborated to design a model educational organization with a purpose of educating future workers who are critical thinkers and problem solvers. Learners needed to apply their theoretical knowledge about organizations working very closely as a collaborating member of a group of 4 to 5 individuals. Collectively, members of each simulation group independently decide how to tackle and organize this very challenging project .

The final product of the simulation was the development of a proposal submitted to a hypothetical state education agency for consideration as a demonstration site. This activity often creates a perceived feeling of competition among the work groups while placing a premium on creativity and synthesis of acquired knowledge of organizational behavior. CEO is composed of what King and Kitchener (1994) would describe as a series of highly ill-structured problems. There are very few right or wrong answers. Because of the ambiguity and the size of the activity, learners often asked questions such as "Is this right?" or "Is this what you want?" Because learners should explore these complex problems within the framework of their own expectations for the learning experience, the facilitator's answers were something like "How are you going to back that up?" or "How do those theories connect with each other?" When really pushed for assurance, the facilitator might say "It looks like your group is heading in a profitable direction." During the early stages of the simulation, learners were often upset by the ambiguity resulting from the lack of direct answers to these specific questions.

Theoretical Framework: Situated Learning

Situated Cognition: the Learning Foundation for CEO

Lave and Wenger (1991) state that "learning is an integral part of generative social practice in the lived-in world" (p. 35). They describe their concept of legitimate peripheral participation as a "descriptor of engagement in social practice that entails learning as an integral constituent" (p. 35). Participation becomes a way of engaging the learner. Participative learning involves "...both absorbing and being absorbed in - the culture of practice" (p. 95). The CEO simulation likewise requires each group to formulate and learn within their own culture of practice.

Lave defines situation has having two basic properties. First, an individual encounters a learning situation within the context of their own setting (Lave, 1988). A setting is comprised of the immediate conditions that are encountered by a learning individual including many interacting elements such as people, equipment, atmosphere, and tasks to be completed. Using Lave's views of situation, each CEO group member would formulate his or her own role to be played in the learning community.

Learning transfer.

Lave and Wenger (1991) characterize the potential to use knowledge in more than one setting as "generalizable knowledge." They posit that knowing a:

> "general rule by itself in no way assures that any generality it may carry is enabled in the specific circumstances in which it is relevant. In this sense, any power of abstraction is thoroughly situated, in the lives of persons and in the culture that makes it possible." (p. 34)

In other words, generalizability of acquired knowledge to other situations is rare and unpredictable. "The generality of any form of knowledge always lies in the power to renegotiate the meaning of the past and future in constructing the meaning of present circumstances" (p. 34). Detterman (1993), argues that there is no general cognitive skill that promotes learning transfer, and emphasizes the importance of contextualized learning. Like Detterman, we believe that teaching should facilitate learning in a situation as close as possible to the one where the learning will be applied. In that way, knowledge has a better chance of being activated when it is needed (Sternberg & Frensch, 1994).

Teaching for Active Knowledge

Principles of cognitive apprenticeship have been adopted to organize the instructional environment for acquisition of active knowledge. Increasingly, this approach has been advanced as an appropriate means of teaching through the use of "situated" activities (Brown et al., 1989). Cognitive apprenticeship uses the traditional concept of craft or trade apprenticeship as a prevailing metaphor for teaching authentic activity through guided experience by focusing on the teaching of symbolic mental skills.

The CEO simulation is founded on four interacting elements - content, methods, sequence, and sociology (Berryman, 1991; Collins, Hawkins, & Carver, 1991). The "building blocks of cognitive apprenticeship" are not new to education, but taken together they do define an effective learning situation (Berryman). These elements constitute the framework of a very different classroom, including different roles for teachers and learners.

Content. Content refers to the types and levels of knowledge required by experts to solve complex problems in the real world.

Methods. The instructor's role is to mediate or facilitate learning, as opposed to being a provider or transmitter of knowledge. Likewise, learners emerge as active participants who guide the learning process rather than assume traditionally passive roles. As a facilitator, teachers in a cognitive apprenticeship model employ a number of instructional methods that capitalize on the immersion of learners in the culture of expert practice. Articulation methods are used in an effort to encourage learners to verbalize their knowledge, reasoning, or approaches to problem-solving (Brown, et al., 1989). Reflection strategies further enhance learner competence by enabling them to compare their own mental problem-solving against those of an expert (Schon, 1983).

Sequence. Instructional sequence can be thought of as three basic strategies including increasing knowledge capacity, increasing contextual diversity, and presenting global skills before local (Brown et al., 1989).

Sociology. The final characteristic of the cognitive apprenticeship model emphasizes the importance of beliefs, values, and social settings in which real-world learning takes place. Four aspects of sociology are important including situated learning, community of practice, intrinsic motivation, and maximizing cooperation.

These aspects of cognitive apprenticeship are employed to encourage and foster collaboration and cooperation among learners to enhance our collective problem-solving capabilities. These approaches enhance the learner's ability to gain control of their metacognitive strategies while affording additional opportunities for learners to observe and emulate expert models of problem-solving.

Purpose

The purpose of this research was to explore how learners used acquired knowledge with regards to their perceptions of: pertinence of the course content, authenticity of the CEO simulation, and impact of articulation and reflective teaching strategies. Consistent with analytic induction research methods, we have identified four preliminary hypotheses that emerged from a review of the literature and our preliminary analysis of all sources of data. Those working hypotheses were:

1. Learners who perceived course materials as pertinent to their work/professional situation are more likely to use their knowledge to solve organizational problems in their workplace.

2. Learners who perceived the CEO simulation as more "real" were more likely to use the material to solve organizational problems outside of class.

3. Articulation instructional practices enhance the learner's active use of the acquired knowledge.

4. Reflective instructional practices enhance the learner's active use of acquired knowledge.

Methods

Participants

Class members ranged in age from 25 to 52, with only two members under 30 years of age and the majority in their forties. Teaching experience of the class members ranged from one to twenty-one years. Only three of the members actually lived near the university, and two of these worked full-time and attended weekend or night classes. The rest of the learners commuted to the university on weekends after working full-time all week at their jobs in secondary and post-secondary settings as administrators and teachers around our state. The exception was one learner who commuted, but did not work full-time. They are nontraditional learners who are affectionately called the "weekend warriors" by faculty within our department. They have families, friends, jobs, and lives that are quite apart from campus life. These learners comprise a very disparate group of learners with diverse needs and expectations about the classes they take.

Research Strategy

We have conducted this research using analytic induction strategies (Robinson, 1951; Znaniecki, 1934) . Husband and Foster (1987) define this strategy as a "systematic attempt to code data while also generating theories about the data being coded" (p. 56). Our primary research emphasis was on the identification of negative cases that refute the preliminary hypotheses. We also placed emphasis on the identification and analysis of cases that were confirmatory. The hypotheses were continually refined until all examples were accounted for and explained (Goetz & LeCompte, 1981). No analytic induction research is ever considered final. From this perspective, reality is viewed as incessant and constantly changing (Znaniecki, 1934) .

According to Patton (1990) an inductive approach begins with experiences of each individual where the focus in on "full understanding of individual cases before those unique cases are combined or aggregated" (p. 45). Therefore, themes that emerged as a whole were examined after an analysis of individual cases.

Data Collection Methods

Two principal research methods were employed in support of our inductive strategy. First, unobtrusive measures used to collect data from documents that were generated as a natural part of the class (Denzin, 1978). These measures included observations of learner performance in small groups, mid-course evaluations, instructional activities, and proposals that resulted from the CEO simulation. Detailed field notes were compiled by both researchers throughout the course of the study.

Second, semi-structured interviews were used for the purpose of capturing the expression of opinions or beliefs of the respondents (Merriam, 1988). This method allows the respondent to take the interview in the direction he or she wishes within the framework of the research (Husband & Foster, 1987). Six learners were selected for interviews. The second researcher's role as a class member and participant observer allowed the interviews to be conducted affording more freedom for respondents to be frank and forthcoming in their remarks. The interviewees were selected on the basis that they were "typical" of the learners in the class and represented each work group. A semi-structured interview approach was used to ask similar questions of each interviewee. The richness of this approach lies its flexibility to explore the important aspects of each participant's experience.

Data Analysis

1. We analyzed each data source for congruence and noncongruence (looking for exceptions) with the hypothesis. These data sources included field notes, midcourse and final course evaluations, class members' written reflections, and interview transcriptions. These documents were analyzed paragraph by paragraph for themes.

2. According to congruence and noncongruence, selected data were placed on a 2 by 2 matrix (use by pertinence, use by reality, use by articulation, use by reflection).

3. The third level of analysis combined cases with levels of knowledge use (high-, medium, and low) by perceived pertinence and reality. Articulation and reflection were analyzed in terms of ill-structuredness and well-structuredness of the perceived problem.

4. These findings were further analyzed by each researcher individually resulting in separate written summaries of themes and linkages between themes according to expected and unexpected findings. These findings were then placed in the context of a written report. Selected respondents were asked to examine the report checking the quotes and interpretation for accuracy. 5. A final version of this research was edited from that draft. The written summaries of each researcher's perspective were jointly analyzed and combined. Due to the high level of agreement between researchers, it was determined to write the final draft as a blended perspective.

Findings from Our Combined Perspectives

In this section, each hypothesis is presented along with summary data that is confirmatory or nonconfirmatory for that position. Near the end of this section the unexpected findings that have resulted from the analysis are discussed.

Hypothesis #1: *Learners Who Perceived Course Materials as Pertinent to Their Work/Professional Situation are More Likely to Use Their Knowledge to Solve Organizational Problems in Their Workplace*

Nonconfirmatory finding: Different knowledge uses for different persons. During data analysis, it became obvious that class members had different reasons for being there. Each had different expectations for what they wanted to learn from the class, and dissimilar ideas about how to apply the material to their outside lives. In this regard, Schon (1987) has stated:

> "when a practitioner sets a problem, he [or she] chooses and names the things he [or she] will notice...and selects things for attention and organizes them guided by an appreciation of the situation.... Those who hold conflicting frames pay attention to different facts and make different sense of the facts they notice." (p.4-5)

Because different motivational factors operate for each individual, it is not surprising that class members used the information in different ways. Patton (1990) stated that "a common activity for all learners can result in drastically different outcomes for different individuals depending on how they approached the experience, what their unique needs were, and which part of the activity they found most stimulating" (p. 98). We believe that this was very evident in this group of learners. Each came to the class with a different agenda depending on what they expected. This influenced what aspects caught their attention, and what they eventually took with them from the class. For Learner #1, it was self-esteem, communication, the courage to make changes in his/her own classroom and empowering him/herself through documentation of events at the school. For Learner #2, it was seeing the perspectives of others and trying some new instructional approaches in his/her own classroom. For Learner #3, it was looking at how his/her organizational hierarchy works and making fundamental changes in the classroom especially dealing with changes in the assumptions about how knowledge is acquired. For Learner #4, it was the courage to make a significant change in his/her organization by testifying in a discrimination lawsuit and also by extending this to become more involved in community affairs. For Learner #5, it was seeing how to make changes in postsecondary institutions across the state in a research capacity. And yet, for Learner #6, the class was a disappointment because it was too "theory oriented" and not practical enough. Learner #6 stated:

> "We talked about kinda fluffy, iffy kinds of stuff that -- you know -- sounded real idealistic and it is good to think about those things, but I really didn't see a lot of fantastic stuff that could be applied back to individual work situations. "

In the early stages of our analysis, we observed that some learners attempted to make changes in organizations. These findings were initially viewed as more active use of the information. Others appeared to use the organizational information to facilitate changes in the culture of the classrooms where they taught. Upon reflection, re-reading transcripts, and member-checks with participants, we decided that participants would not agree that their use of acquired knowledge would be accurately described as passive or active. This led us to seek an alternate explanation. As we reanalyzed the data in light of the different ways people used the information, it became clearer why some learners chose to make changes in the culture of their classrooms rather than directly attempting to make more overt attempts at larger organizational changes.

> Tracy: " *You come to realize..in your own little domain in your classroom, sometimes, you don't get that concerned about the big picture of how things are operated because...once that door is closed, you kind of feel empowered to do what you want to do, and then run your class the way that you want to run it.* "

We have evidence that learners did use course information in ways that best suited their personal and professional needs and they were empowered to take charge of their own learning. As John Dewey stated:

> He has to see on his own behalf and in his own way the relations between means and methods employed and results achieved. Nobody else can see for him, and he can't see just by being "told," although the right kind of telling may guide his seeing and thus help him see what he needs to see. (1974, p. 151)

Confirmatory finding: Learners take action. The degree to which class members empowered themselves to use their acquired knowledge varied widely. In some cases the learning experience was extended into individual's working lives. Some of our co-learners did take direct action as a result of their experiences in this class. Jean reported having a profound experience as a result of his/her participation.

> Jean: " *The president in my school has certain ways of doing things, another instructor brought a case against him, and I was called in to testify.* "
>
> *Rhonda: "Tell me more about that. "*
>
> Jean: "*And we testified...before a lawyer from the attorney general's office. And we presented the information to a judge. The case involved the school [which is] thirty years old and has never hired a minority administrator. Yet, it hired some white administrators that only have a high school education and we have a minority person who has a doctorate... This president, we feel that he has made a deliberate attempt not to hire minorities so we brought this case before the attorney general. A decision should be rendered within the next six months. I think being in that class made me become a part of that because I have been on board for at least 21 years, but this class really inspired me. Like [the instructor] was saying in the class, when you challenge an organization ... you have to be willing to go the distance, and you have to know that what you're doing is correct, and is best for the institution and I feel that he inspired me to do that from that class.*"

Jean was empowered to make an important contribution to his/her organization because he/she expected that efforts made in this context would result in desirable outcome(s). This learner participated in the legal action because there is a perceived connection between his/her efforts and a desirable outcome. These expectations also have instrumentality because there is the potential for favorable outcomes for other minority learners. Jean believes that this will lead to other desirable conditions.

> Rhonda: *So you think that some of the things we had to think about, organizational change, [were] instrumental in you taking a role in this case? Jean: Yes, it was very instrumental in me taking a role in that I think it is going to be good for the community, it's going to be good for the people we serve, and it's going to be good for the minority students on campus ... its going to be good for the overall organization. It will bring us in line where we should have been in the past.* "

There were other examples of learners who used the course information to make changes in the culture of the classrooms where they interact with students every day. After much reflection, we have come to accept these changes as limited evidence of learning transfer. Mackenzie reported:

> *"I thought [the instructor's teaching] technique was very very good. I have started using it in my own classroom. It makes you think and try to start putting things together... It's just a good way of teaching long term for long range effects.*

When pressed about using the course information to help solve larger organizational problems beyond the door of his/her classroom, Mackenzie equivocated.

> *"Basically, I've just taken it -- like I've used it more in class. I do have a little more insight about how the*

> *organization that I work for... [a local school], is set up and things that have happened. Basically, I've tried to incorporate more in my teaching and it seems to be going very well. n "Here we have a case where we've [been] asked to do a lot of information research and what we think we need to do to improve our program, but not much is going to come from that.*
>
> *Rhonda: "How come – why don't you think the administration will support it?"*
>
> *Mackenzie: "I don't want to say [they want to] make us feel good, but maybe that's something to do to try to get our input. I think they pretty much know what they are going to do anyway."*

It is apparent that Mackenzie does not have strong expectations with regard to his/her ability to influence the emerging direction of their organization. He/she apparently does not perceive a sufficient connection between effort and reward to justify such expectations. Mackenzie's expectation of non-inclusion was not isolated. Several other learners reported making a contribution to their organization by adopting some of the instructional methods from this class was the only way that they could safely make a difference in their organization. We have come to believe that the degree to which knowledge is activated is somehow a function of the learner's expected use of that knowledge.

Hypothesis #2: *Learners Who Perceived the CEO Simulation as More "Real" Were More Likely to Use the Material to Solve Organizational Problems Outside of Class*

With regard to this hypothesis, the data were neither confirmatory nor nonconfirmatory. We observed several instances where learners were engaged at different levels of situatedness with the CEO simulation. Even allowing for individual differences, from a more generalized perspective, the simulation was simultaneously perceived by class members as real and not real.

CEO only partially situated. Some learners perceived the biggest differences between the simulation and the real world to be the level of risk involved and the freedom to try new things without administrative or public backlash. Comments from two learners illustrate these points.

> *Tracy: " The idea of a group making a proposal was very realistic in the sense that in schools, and in vocational education, we are in the process of writing proposals for grants to get monies for programs. And for me it was probably more applicable than actually changing the organization. In a simulation, you don't have the public outcry, the backlash from the public, the administration, or whoever it is that you are trying to change. With a simulation, you are basically just putting it on paper, so everything looks nice, and everything seems possible."*

An entry in the instructor's field notes indicated that in the simulation learners could take more risks and were not bound by administrative constraints.

> *I asked why the groups were so extraordinarily motivated. One student suggested that it was because groups were free to be creative and innovative. In fact, it was expected. If these projects took place in real life, however, there would be a great deal less innovation due to the politics and an organizational structure that is*

> *self-perpetuating and not oriented to educating flexible workers.*

Learners were encouraged to think about the ideal school situation and conditions for optimal learning, but CEO does not require learners to deal with the sometimes harsh realities of resistance to change in educational organization.

Although most students described themselves as engaged with and highly motivated by the CEO simulation there is further evidence that the simulation was perceived mainly as an academic exercise.

> Pat: "*[In other classes] we actually talked about real life applications for things and not so much theory about what might be -- what could be -- you know -- what theories are out there -- we talked about real stuff what has really worked -- we were challenged to go out and try things and see what would work and then come back and talk about what worked and didn't work....I didn't get that from this particular class.* "

While it is true that much of the content was about research in organizational behavior, the class did have a strong ethic of interpreting that literature in the context of everyday situations. Pat adds that this particular application was not sufficiently authentic to engender strong expectations or connections between theoretical knowledge and the real life "tricks of the trade" that he/she expected to acquire from this class. In this way, the CEO simulation was perceived by our co-learners as simultaneously real and not real.

Hypothesis #3: *Articulation Instructional Practices Enhance the Learner's Use of their Acquired Knowledge*

Our third and fourth hypotheses were initially based on the instructional importance of articulation and reflection (Brown et al., 1989). We found a chain of evidence to support an instructional connection between articulation and reflection practices. Although one might intuitively know that trust is important to group learning, we had not fully appreciated the extensive role that trust plays in enabling individuals and groups to construct new knowledge and extrapolate meaning from it. We found that articulation is most effective when combined with other instructional practices (i.e. reflection). However, the chain of evidence was more complicated than we anticipated. Articulation instruction involves the development of some level of trust as a foundation for full disclosure.

Confirmatory finding: Articulation in an environment of trust. Within the context of our research, some level of trust was engendered because learners' points of view were carefully considered by all members of the learning community. Learners were asked to articulate relationships between theory and real world practices through the use of probing questions. An entry from Rhonda's field notes pointed to the importance of articulation as an aspect of higher order thinking.

> *"I recognized some things that I inherently knew but did not formally or officially know until today. I think this is because of the articulation and reflection. A lot of times you don't know that you know something until you have to put it into words and explain it to someone else."*

Tracy talks about articulation instructional methods as a way to activate knowledge and promote alternative ways of viewing an issue.

> "[the instructor's style of questioning] "really stimulated a lot of class discussion, and got a lot of the students involved, and a lot of good verbal exchanges took place. And one student would take one side of an issue of motivation and someone who read the same article, would have a different perspective..and some good dialogue took place."

But, this unique kind of articulation depended on the development of a culture of trust and safety among class members.

> Mackenzie: "*We were encouraged to discuss a lot of our ideas and thoughts and to ask questions -- I never once felt that I couldn't ask questions or tell an opinion about something that about something that somebody else said. I felt like we all respected each other and there was an atmosphere where there was open discussion and we could say whatever we felt.* "

Asking the right question at the right time further maximizes opportunities for learners to express their points of view. In discussing their knowledge, learners reveal their conceptions, reflect on them and to grow intellectually through a the literal construction of knowledge that is new and meaningful to them (Brooks & Brooks, 1993). "Teachers' ability to uncover students' conceptions is, to a large degree, a function of the questions and problems posed to students" (p. 65).

> Taylor: *The classroom atmosphere was relaxed, jovial, and yet at the same time, it was also challenging because [of] the instructor's method of pulling in the theory into the discussion, really caused everyone to think. You had to really be able to match the textbook information and the lecture information with the kinds of things that we were doing in the groups and in the discussions.* "

Lynn also cited the class ethic of trust that engendered involvement and participation encouraging learners to verbalize their acquired knowledge.

> Lynn: "*People in that class couldn't wait to step in. Some would say something and you'd see someone immediately almost jump out of their seat to say something. And they never felt like they could not say anything. In fact, we had several that would contradict even [the instructor]. And he would say, 'I'm listening' and he would mean it, he would be listening. And I felt very comfortable. I didn't always agree with everything that he said, but if I could justify it, he accepted it and I appreciated that. And it did help the class discussions get going, and it made them even deeper.* "

There is, however, evidence on the other side of the coin to suggest that when levels of trust are reduced, articulation is also more limited.

Hypothesis #4: *Reflective Instructional Practices Enhance the Learner's Active Use of Acquired Knowledge*

Again, based on our evidence, this hypothesis should be retained in some form. However, we have come to believe that when articulation and reflection are considered separately, the instructional power of each technique is diminished. Our belief is that these concepts are most effective when used together as instructional tools. This insight has led us to reconsider our original belief that articulation and reflection were independent of each other, and could be expressed as separate hypotheses.

When a foundation is established for articulation, new knowledge is often socially constructed. By hearing the perspectives and experiences of others, one often reflects on the meaning of learned information and its implications for their own practice.

> Taylor: *Because of what you are doing, through the use of those higher learning skills, synthesis and evaluation, you just can't go to a textbook and pull something back out and then regurgitate it. You're having to take a very amorphous kind of a situation and coalesce all these different ideas, thoughts and philosophies, and beliefs, and pull [them] together into something that is sensible and is potentially useable.* "

Confirmatory findings: Trust and articulation leads to reflected meaning. A purpose of this class was to encourage learners to question existing management practices. Reflective instructional methods helped learners see others' opinions and viewpoints and encouraged them to consider alternate views. A few individuals reported looking at their organizations differently resulting in an increased understanding of organizational practices. By having to create an organization, class members put themselves in the shoes of the administration and considered their reasons for doing things and the implications of those actions .

In talking about the classroom environment, Mackenzie stated: "The environment enhanced [motivation] by having the discussions and the creativity to challenge other people's viewpoints and challenge our own viewpoints. " Others shared this perspective:

> Jean: "*It [the class discussions] made you think about the old way that you perceived things and gave you some other possibilities of looking at situations.*"

Taylor spoke of how articulation led to his/her reflection on the meaning and application of course materials.

> Taylor: *The experience that we had in the class was that when one student brings up a particular set of circumstances.... that will spark a thought in another student, and you have a chain reaction that occurs. That gives you a really wide spectrum of different possibilities....any time you can take a real life situation and apply it to an academic point then you will have a good transition, and that was the case here. That the information that we were receiving became meaningful when you could relate it to your everyday working situations.*

In summary, it has been our experience that articulation instructional strategies provide many opportunities for learners to view their acquired knowledge from alternate viewpoints. In this context, articulation of ideas further enhances reflection on the meaning and application of information.

Other Findings That Emerged From the Analysis

As is common in qualitative research, several unanticipated themes emerged. In this case, these findings provide a rich context for deeper analysis and understanding of situated and collaborative learning.

Unnecessary competition may inhibit trust affecting articulation and reflection. Dividing the class into groups produced an element of perceived competition which served to simultaneously enhance and inhibit learning. The competition enhanced learning by providing motivation to form groups that were cohesive, working together to produce a good quality project. One learner described competition as enhancing the quality of their project:

> Jean: *"My group was competing with the other groups. Because our mind set said that we are going to deliver the better project. We competed as if it were going to be cash money, and we also wanted quality in the project."*

Jean felt that competition against the other work groups added to the realism of the project. But, the negative side of competition reared its ugly head towards the end of the quarter resulting in limited sharing of ideas and protected "turf." Another learner described the perceived competition this way:

> Taylor: "*Well, there's always that element of competition [both laugh] and you know, its one of those things where ... you go up to where another group is working and you see -that they have five more pieces of paper than you have and you say Oh, my God! What are they doing?*"

Perceived competition inhibited the benefit of gaining different perspectives from others' viewpoints and the sharing of information. Another way that competition inhibited the learning process was that work groups were not open to new information near the end of the quarter. Tracy explained that:

> *"I wanted to work on the simulation. We got involved...in the project and applying some of the things that we learned in class, about how to change organizations, and that was more important than just getting new information and new material... and to be honest, I could have cared less about discussing new material* . "

The element of competition also shows support for motivation coming from within the groups rather than from the instructor, thus providing a potential support for self-empowerment. In this case the instructor had less power over individuals than did group members. The motivation for producing a good project came from the other group members rather than from the grade they would receive from the instructor. These conditions contributed to the perceived competition while increasing initial tension among learners .

Initial tension resulting from the ambiquity of the CEO simulation. From the mid-course evaluation, 50% of the comments regarding suggestions for improvement identified wanting more structure or guidelines for the project. At the end of the course, however, learners better understood the role of ambiguity. Taylor described some of the tension he/she felt about the project, but also describes why it was necessary.

> *"I think the ambiguity of the project, has its] pluses and cons. The cons first, I would say that because it is so ambiguous that you have an anxiety level that goes with this. It takes you out of the mainstream of your educational format that you are use to following which is basically listening to an instructor provide information and then you regurgitate that. This is a quantum leap from that. So there is a discomfort factor when you move away from that. The pro, of course, is that, in real life, you have the kinds of situations that we've experienced with the project, plus,*

> *in real life a lot of work that you do is ambiguous. And I find that in my work every day. We'll receive direction from a funding body or from some of our clientele and it is incomplete information and we have to make decisions on how we use that information. So in terms of gaining valuable insight in real world situations, I think that class structure was very helpful and very positive.*

Schon (1987) agrees that "problems of real-world practice do not present themselves to practitioners as well-formed structures. Indeed, they tend not to present themselves as problems at all but as messy, indeterminate situations" (p. 4). However, the ambiguity of the project, did provide an environment where reflective thinking could occur. "Reflective thinking is called for when there is awareness of a real problem or when there is uncertainty about a solution. Reflective judgments are based on the evaluation and integration of existing data and theory into a solution about the problem at hand" (King & Kitchener, 1994, p. 8). The ambiguity or ill-structured nature of the simulation promoted reflection as did the articulation instructional methods. But, learners initially experienced some tension with the instructional methods as well.

Non-Confirmatory theme: Cognitive apprenticeship methods are new . There is some evidence that at first, articulation was difficult as were the alternate forms of instructional sequence (i.e., global before local).

> Taylor: "*I would say that the only way the style [articulation instructional methods] inhibits is that you can have instances of mentally blocking when you go from the general to the specific. It's easy to discuss the general because you can draw from life's experiences to make a comparison to the material in the text and the presentation to your own life's experience, and when you go from the general to the specific, then sometimes, you have a tendency, unless you run back to the text to forget exactly what the specifics tend to be.*"

Taylor's comment illustrates why articulation may be difficult and explains some of the uncomfortable silences that occurred the first few weeks of class. The comfort level increased and learners became more relaxed as time progressed.

> Pat: " *There were times when during the discussion things would get kind of tense because we weren't sure exactly what answers [the instructor] was looking for. But after awhile, we just learned that we just needed to be prepared and it got more relaxed as the weeks went along.*"

As the learners became more relaxed with the new instructional methods, articulation became a way of activating knowledge.

> Lynn: "*I found [the instructional methods were very different from what I was used [to and] I was expecting...I said, 'I like this because I'm listening and I'm hearing what is going on and that's what I came for. I wanted something that I could expand. So, I found that the instructional method was great--it suited me.*"

> Rhonda: *Tell me what you mean by expand.*

> Lynn: "*[The instructor would ask [a question and] he would never tell me a direct answer and sometimes I would say, 'Now, I*

> *wish he would tell me the answer. ' But, he would make me think...let me reason what the answer would be... that's what I meant by expand. He made me think and that was very good."*

The tradition of articulating our acquired knowledge became more comfortable with the passage of time. But, we later realized that the real foundation for the articulation and reflection instructional methods was mutual trust. Before learners would openly articulate opinions (which promotes seeing others' perspectives), a certain level of trust had to be present.

Implications For The Practice of Situated Learning/Teaching

In this section we will synthesize and report the lessons we learned in conducting this research. Consistent with an analytic induction strategy, we reformulated our original hypotheses to better explain the results obtained. These statements also construct a platform for our future research. Following each statement of reconstituted hypotheses, each of the major themes that have influenced their development are discussed.

Reformulated Hypothesis #1: *When unnecessary competition between groups is Perceived it may serve to inhibit communication, and Possibly restrict the learning connection between articulation, reflected meaning and constructed knowledge.*

Perceived competition. Competition did play a negative role by inhibiting communication between CEO work groups. However, there is evidence to suggest that it accomplished a positive function within the groups. Competition helped some groups become more cohesive and enhanced motivation for producing high quality projects. However, insufficient evidence exists to demonstrate this as a universal phenomenon within all groups. This conflicting finding, that competition enhanced some processes while inhibiting others, made our analysis more perplexing because it seemed so interconnected with motivation and trust. It was difficult to understand the role competition played in our research until we realized how our different perspectives and roles as instructor and student influenced our interpretations. Until that point, we both recognized competition was there, but placed different emphasis on it. Competition, from a student perspective, was a very strong theme that has been present in schooling from early experiences until the present. In an instructor role, it was a background theme, due to the expectation and desire that learners would cooperate rather than compete. The instructional implications are that competition may be used to enhance the reality or situatedness of an activity, and to form cohesive work groups. It is naive to believe that competition in a school setting will be eliminated just because the instructor desires it. Learners' past socialization experiences are too strong to reverse in 10 weeks. Thus, competition should be expected and used in a positive manner. Our only hope is that repeated exposure to cooperative learning environments may, over time, enable learners to engage in collaborative learning in a less competitive surroundings.

Reformulated Hypothesis #2: *When learners experience contextualized learning situated expectancies" are present within each individual. Under the right conditions, these expectancies can lead to self-empowered learners potentially resulting in more active use of constructed and/or transferred knowledge.*

Relationship of Situation and Learner Expectations. One of our original hypotheses was based on the assumption that realism and pertinence would lead to active use of course materials to resolve problems in the learner's work place. After conducting this research, we realize that it was quite naive to assume that direct learning transfer would occur as a direct result of a class setting that was only semi-situated. Although several learners provided evidence of using the information, its use was most often determined by each individual's expectations for that knowledge. What emerged for us was the importance of understanding how the expectations of learners dictate how they choose to interact with and learn within their environment.

In future research we believe that it will be productive to consider the expectancies of each learner with respect to their perception of the realism of the learning environment. Vroom's (1965) work on expectancy theory of motivation is a potential foundation for an individual's interpretation of a learning situation. This approach has several theoretical appeals. First, expectancy theory is based on how an individual interprets a particular setting and evaluates its potential for obtaining a successful result. In this context, the determination of success is made by each learner based on the degree to which their expectations are achieved. This concept is consistent with Lave's concept of situated learning where an individual acquires knowledge according to their own way(s) of knowing and their interaction with the culture of the learning place. Expectancy theory is further directed by the valance, or strength of a particular expectation. The stronger the valance, the more likely an individual is to be motivated about learning.

Situated expectations are potentially transitory and anxiety producing. Teachers interested in facilitating this type of learning, are encouraged to think of learner expectations as potentially transitory. The expectations of our co-learners was different as the quarter progressed. Mackenzie described the how his/her expectations changed.

> *"At first, it was more like a project for a class. Then as we got into it, we started making it more personal and it became a project more like it would be a real project. We were meeting deadlines, we were going back and doing a lot of revisions, and I believe it changed from a view of just a project for a paper for a grade, [to] a real project."*

Others suggested that as time grew short at the end of the quarter, they began to view the simulation as a project to be completed. At that time, learners' readiness for new ideas and concepts was severely restricted. Learners exhibited signs of stress at the beginning and end of class. Students who had never participated in this type of class were unsure of how to learn in this type of environment--what do I have to do to get an A? At this point, their trust was not yet sufficiently developed. As time went on, however, they began to develop trust in their co-learners. As trust emerged, learners empowered themselves based on their new expectations. During the later stages of the quarter, time factors began to once again reshape learner expectations. Several reported that the simulation became a project to be managed. At these stages, learning was also inhibited and anxiety again resurfaced. For us, this project illustrated the importance of structuring educational experiences to allow trust to emerge as a culture of the class.

Teaching/learning strategies for activating knowledge. While Detterman (1993) argues that learning transfer is truly a rare occurrence, these results suggest that learning can be activated and made, at least to some degree, useful in the lives of learners. If we accept Detterman's definition of transfer, (the degree to which a behavior will be repeated in a new situation) the results of this research would suggest that some level of learning transfer has been obtained.

We believe that these results were obtained partially because we employed teaching strategies that encourage active use of knowledge. Elements of cognitive apprenticeship are similar to mechanisms of learning transfer as described by Sternberg, and Frensch's (1994). We believe that these perspectives formulate a solid theoretical foundation for cognitive apprenticeship teaching/learning. When these techniques are employed in an environment of trust, articulation, and reflection, learned information is much more likely to be active and applied when similar situations are encountered.

Reformulated Hypothesis #3: *When cooperating learners cultivate an atmosphere of trust and safety, individuals often empower themselves. Such empowerment can enable articulation of newly constructed knowledge therefore promoting "reflected meaning."*

Connections: Trust-Articulation- Reflection. It appears to us that learners learn best when they are encouraged to talk about their newly acquired knowledge and then reflect on its meaning to their personal situations. Articulation and reflection strategies are maximized in a culture where some level of trust among co-learners can be established.

Articulation practices engender reflected meaning of information. When co-learners are encouraged to verbally make connections between theory and application, the first steps may be taken that will lead to making acquired knowledge more active. These practices are supported in theory by Lave and Wenger (1989) assertion that knowledge is socially constructed. In this way learners are more directly connected to the information. Bransford and Vye (1989) assert that these connections are motivating. Our research lends strong evidence with regard to learner motivation and reflected meaning founded on alternative perspectives.

Future research: Connection between reflected meaning and active knowledge.

Creating a climate of trust where articulation and reflection is allowed to resonate is often a difficult task for college professors. Likewise it can be very difficult for some learners to achieve sufficient trust in an academic environment to maximize this teaching and learning paradigm. When learners and teachers empower themselves to view their common roles as scholars, the teaching/learning task can be moved beyond the traditional "power to the teacher" position. One instructional technique for encouraging this transition of power is fostered when instructors learn to listen to their co-learners in a atmosphere of mutual respect and thoughtful consideration of the learner's point of view.

In summary, this research clearly describes a group of highly motivated learners. The motivation occurred when individuals empowered themselves. They gave themselves permission to become assertive learners. This motivation would seem to come from several sources including relatively secure work groups, and the classes' strong ethic for openness and exchange of ideas. These aspects of our class culture were not gifts received from the professor. These rights naturally belong to every individual in a democratic society. Yet, that freedom, when blended with the expectation of academic excellence can encourage learners to assume responsibility for their own learning.

The theme of trust is a melody that played continuously throughout this research. When these learners exercised their natural right to pursue knowledge, they also came to respect these rights in others. In this way, learners empowered themselves to the extent that they took more social risks. As a result, when expectancies were well matched with the learning situation, and a sufficient level of trust was achieved, a solid foundation for active knowledge was realized.

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MATHEMATICS, READING, SCIENCE, SPEAKING, AND WRITING SKILLS EMPHASIZED IN HIGH SCHOOL VOCATIONAL AND ACADEMIC CLASSES

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Objectives:

Since 1987, the Southern Regional Education Board-Vocational Education Consortium has undertaken an extensive effort to improve instruction that students enrolled in high school vocational programs receive. The overall goal of the Consortium is to advance, apply, and evaluate instructional approaches used by both vocational and academic teachers that will improve student competencies, particularly work-related academic competencies. By 1993, the consortium included 19 states with more than 55 pilot sites involved in the delivery of vocational education at the secondary level. A variety of methods for evaluating the outcomes of the instructional intervention strategies tried at the pilot sites were used. They included administering the National Assessment of Educational Progress tests, assembling transcript data, conducting follow-up studies, surveying and interviewing teachers and administrators, and compiling classroom observation data. For five years, 1989 through 1993, classroom observations at the 3 Virginia sites were completed in classes of vocational and academic teachers.

The purpose of the observations was to provide insight into the instructional experiences of the students. For the observations, frequency of occurrence of events were recorded with basic academic skills categorized as being taught at the "simple" or "complex level" and being taught for the purpose of "learning concepts" or for "application and transfer." The objectives for completing the observations included:

1. To determine the nature of instruction students receive in the basic academic skills of mathematics, reading, science, speaking, and writing;
2. To compare emphasis given to these basic academic skills in vocational and academic classes.

Perspectives:

As Weber, Puleo, Kurth, Fisch, and Schaffner (1988) stated, "The current press for strengthening components in vocational programs can be traced to major changes, both in the nation's competitive posture and in the work place itself, which occurred in the early 1980s (p. 130). They note that these changes have led to increased interest in the appropriateness of our educational system which led to a number of reports on the "rights" and "wrongs" of it and how to achieve excellence in it. As part of the excellence movement, the suggestions offered generally were "more academic rigor" for all students. Yet the authors of The Unfinished Agenda (1984) questioned the assumption "...that more academics, which may be the best preparation for college, is also the best preparation for life" (p. 1). The Secretary's Commission on Achieving Necessary Skills report, commonly referred to as the SCANS report (What Work Requires..., 1991), clearly reinforces the incorrectness of the assumption. The report states that work place know-how skills, ones effective workers need, are much broader than those learned through instruction focusing solely on academics.

Daggett (1984) argued that any dramatic improvements in the preparation of students, especially those who are not college bound, may require major changes in what is taught, when it is taught, and how it is taught, not simply increases in academic course requirements and higher test scores. From a study that included observations of instruction in 649 vocational and 244 academic classrooms completed by Weber, et al. (1988) the investigators concluded that vocational classrooms appear to provide frequent and varied opportunities for strengthening students' basic and higher-order skills, but teachers and students do not appear to capitalize on these opportunities. Thus, a need exists to document more fully just what and how students in vocational and academic classrooms are taught in high school settings.

Research Methods and Data Sources:

At the 3 Virginia sites, observations of instruction were completed in the classes of both vocational and academic teachers in the Spring of 1989, 1990, 1991, 1992, and 1993 by teams of trained observers. A total of 727 classes with more than 11,500 students in attendance were observed. For each class observed, 4 snapshots, each consisting of 1 to 4 episodes, were recorded. A snapshot represents a point-in-time while the episodes explain instructional "process" activities which occur over time and detail the content, depth, and complexity of the instruction taking place within each snapshot. In recording episodes within snapshots, the episodes involving the largest number of students were recorded first then the second largest number, and so on. In 1989, interrater reliability was established for the observation procedures. When observers recorded information for the same episode, extent of agreement ranged form 65.6% to 100%, with agreement of observation data recorded lower than 75% for only 3 of the 23 variables.

Procedures for recording the data were adapted from those used by Weber, et al. (1988). Major changes from the procedures they used were that more information about the instruction in basic academic competencies was recorded and some items of information about classroom detail were eliminated. Further, the procedures for recording the data were adapted for use of op-scan sheets to facilitate data entry and analysis. As with the Weber, et al. study, episodes served as bases for the analyses.

One-way analyses of variance procedures were used to determine differences in the variables recorded between vocational and academic classes. In addition, one-way ANOVAs were used to examine differences in variables for classes in eight instructional areas as follows: English, mathematics, social studies, science, agriculture and trade and industrial, business and marketing, home economics, and technology education. Chi square outcomes indicated that activities in the small number of agriculture classes were similar to those in the trade and industrial classes for the variables recorded. Thus, outcomes for the two vocational areas were combined. The average number of instructional episodes for the vocational classes was greater than the academic classes, 7.8 versus 6.0. This greater number of episodes does not necessarily mean, however, that more instruction was taking place in the vocational classes. Rather it indicates that students were involved in a greater variety of activities. Thus, the ANOVA calculations were based on percentage of episodes per class documented for a given activity. Student-Newman-Keuls procedures were used to determine means that were significantly different from one another.

Results:

ANOVA outcomes comparing instructional emphases in the basic academic skills of mathematics, reading, science, speaking, and writing in the various vocational and academic classes for selected variables follow.

Variable	P > F
Mathematics skills used at complex level	.0001
Purpose of mathematics was for application and transfer	.0001
No mathematics skills being used	.0001
Reading skills used at the complex level	.0237
Purpose of reading was for application and transfer	.0001
No reading skills being used	.0001
Science skills used at the complex level	.0001
Purpose of science use was for application and transfer	.0001+
No science skills being used	.0001
Speaking skills used extensively to present information	.0001
Purpose of speaking was for application and transfer	.0642
No speaking skills being used	.0192
Writing skills used at the complex level	.0001
Purpose of writing was for application and transfer	.0452
No writing skills being used	.0001

Instruction in these selected variables, as with all of the variables related to the basic academic skills, is generally different across various classes. As shown in Table 1, for example, complex math was most likely to be observed in mathematics classes (44% of the instructional episodes), followed by technology education classes (27% of the episodes). For all other classes, the percentage of complex math episodes ranged form 1% in home economics classes to 9% in business and science classes. As for purpose, application and transfer was most likely to be the purpose for math instruction in technology education (55% of the math episodes with purpose identified) and agriculture/trade and industrial education (54% of the math episodes with purpose identified). These were followed by business classes (41% of the math episodes with purpose identified) devoted to application and transfer and, then, mathematics classes (34% of the episodes with purpose identified) devoted to application and transfer.

Table 2 includes ANOVA outcomes for reading, which was the most frequently observed of the basic skills. Students in agriculture and trade and industrial classes and in the technology education classes were least likely to be reading at the simple level. For reading at this level, the percentage of episodes for these classes was 28% and 29%, respectively. Means for reading at the complex level were not significantly different for any of the eight different types of classes. The percentages ranged from 11% in the social studies to 29% in the technology education classes.

Perhaps most interesting, are instances when the basic academic skills were not being used. For example, math was not being used in vocational class instructional episodes as follows: home economics, 85%; agriculture/trade and industrial education, 64%; business, 64%; and technology education 51%. Outcomes for science episodes are even more striking. Science, as shown in Table 3, was not used in vocational class instructional episodes as follows: business, 97%; home economics, 85%; technology education, 75%; and agriculture/trade and industrial, 57%.

Tables 4 and 5 provide outcomes for speaking and writing skills. Although speaking occurred in roughly half of the episodes, speaking extensively or for purposes of presenting information, the complex level, occurred a low of 1% in the agriculture and trade and industrial classes and a high of only 9% in the social studies classes. Writing occurred least often in the agriculture and trade and industrial education classes, 19% of episodes at the simple level and 3% at the complex level. It occurred most often in the mathematics, science, and English classes, 51%, 51%, and 50%. However, in the mathematics and science classes only 6% of the writing episodes were at the complex level; while in the English classes, 16% were at the complex level.

Conclusions and Implications:

This study builds on previous research and provides insight as to the extent that the high school students experience instruction in the basic academic skills of mathematics, reading, science, speaking, and writing in their classes. Further, it details whether in-class use of these skills is provided at the "simple" or "complex" level and whether the purpose of use was for "application and transfer." The outcomes document that both vocational and academic teachers tend to teach these skills at the "simple" rather than the "complex" level. Further, student use of science in all classes, except those specifically titled science, is minimal. Thus, the outcomes can serve to direct professional development of practicing teachers. They indicate that teachers need to learn ways to integrate the use of these basic skills more effectively into their instruction and to emphasize the use of the skills at more complex levels.

This limited discussion related to interpreting outcomes can only touch the surface as far as implications of the study are concerned. The data collected provide a wealth of information about the type and quality of instruction students at the three pilot-site schools received in the vocational and academic classes. The procedures developed for completing the observations have proven to be manageable and the data collected usable. Careful training of the observers was critical to the study. Outcomes of it reveal the current nature of classroom instruction related to basic academic skills and provide a basis from which to implement change

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Table 1

Analyses of Variance Outcomes for Mathematics Skills

Nature of Episodes/ Type of Class	n[a]	Mean	df	F value	P>F
Mathematics Used at Simple Level			7,657	27.9	.0001
Agriculture/Trade	105	.23 B[b]			
Business/Marketing	92	.26 B			
English	149	.01 C			
Home Economics	37	.14 BC			
Mathematics	122	.49 A			
Science	79	.09 C			
Social Studies	39	.00 C			
Technology	42	.22 B			
Mathematics Used at Complex Level			7,657	28.2	.0001
Agriculture/Trade	105	.13 C			
Business/Marketing	92	.09 C			
English	149	.01 C			
Home Economics	37	.01 C			
Mathematics	122	.44 A			
Science	79	.09 C			
Social Studies	39	.02 C			
Technology	42	.27 B			
No Mathematics Used			7,657	104.7	.0001
Agriculture/Trade	105	.64 C			
Business/Marketing	92	.64 C			
English	149	.98 A			
Home Economics	37	.85 B			
Mathematics	122	.07 E			
Science	79	.81 B			
Social Studies	39	.98 A			
Technology	42	.51 D			
Purpose was Application and Transfer			7,381	13.1	.0001
Agriculture/Trade	51	.54 A			
Business/Marketing	66	.41 AB			
English	88	.04 C			
Home Economics	20	.19 BC			
Mathematics	75	.34 AB			
Science	42	.18 BC			
Social Studies	20	.05 C			
Technology	27	.55 A			

[a] Number of classes

[b] Means with same letters are not significantly different

Table 2

Analyses of Variance Outcomes for Reading Skills

Nature of Episodes/Type of Class	n[a]	Mean	df	F value	P>F
Reading Used at Simple Level			7, 656	8.0	.0001
Agriculture/Trade	104	.28 B[b]			
Business/Marketing	92	.57 A			
English	149	.44 AB			
Home Economics	37	.53 A			
Mathematics	122	.59 A			
Science	79	.44 AB			
Social Studies	39	.56 A			
Technology	42	.29 B			
Reading Used at Complex Level			7, 656	2.3	.0237
Agriculture/Trade	104	.15 A			
Business/Marketing	92	.25 A			
English	149	.25 A			
Home Economics	37	.12 A			
Mathematics	122	.26 A			
Science	79	.22 A			
Social Studies	39	.11 A			
Technology	42	.29 A			
No Reading Used			7, 656	15.1	.0001
Agriculture/Trade	104	.56 A			
Business/Marketing	92	.18 C			
English	149	.31 B			
Home Economics	37	.35 B			
Mathematics	122	.15 C			
Science	79	.34 B			
Social Studies	39	.32 B			
Technology	42	.42 B			
Purpose was Application and Transfer			7, 384	4.6	.0001
Agriculture/Trade	51	.84 A			
Business/Marketing	67	.80 AB			
English	89	.64 AB			
Home Economics	20	.86 A			
Mathematics	75	.54 B			
Science	42	.56 B			
Social Studies	20	.60 AB			
Technology	28	.79 AB			

[a] Number of classes

[b] Means with same letters are not significantly different

Table 3
Analyses of Variance Outcomes for Science Skills

Nature of Episodes/Type of Class	n[a]	Mean	df	F value	P>F
Science Used at Simple Level			7, 654	48.2	.0001
Agriculture/Trade	105	.29 B[b]			
Business/Marketing	91	.03 C			
English	149	.02 C			
Home Economics	37	.14 C			
Mathematics	121	.03 C			
Science	79	.59 A			
Social Studies	39	.03 C			
Technology	42	.14 C			
Science Used at Complex Level			7, 654	23.6	.0001
Agriculture/Trade	105	.14 B			
Business/Marketing	91	.00 C			
English	149	.01 C			
Home Economics	37	.01 C			
Mathematics	121	.02 C			
Science	79	.34 A			
Social Studies	39	.00 C			
Technology	41	.11 BC			
No Science Used			7, 654	119.4	.0001
Agriculture/Trade	105	.57 C			
Business/Marketing	91	.97 A			
English	149	.97 A			
Home Economics	37	.85 A			
Mathematics	121	.96 A			
Science	79	.08 D			
Social Studies	39	.97 A			
Technology	41	.75 B			
Purpose was Application and Transfer			7, 169	19.8	.0001
Agriculture/Trade	56	.92 A			
Business/Marketing	5	.60 AB			
English	10	.63 AB			
Home Economics	9	.89 A			
Mathematics	9	.42 AB			
Science	75	.22 B			
Social Studies	1	1.00 A			
Technology	12	.73 AB			

[a] Number of classes

[b] Means with same letters are not significantly different

Table 4

Analyses of Variance Outcomes for Speaking Skills

Nature of Episodes/ Type of Class	n[a]	Mean	df	F value	P>F
Speaking Used at Simple Level			7, 657	2.1	.0414
Agriculture/Trade	105	.56 A[b]			
Business/Marketing	92	.43 A			
English	149	.48 A			
Home Economics	37	.47 A			
Mathematics	122	.55 A			
Science	79	.58 A			
Social Studies	39	.53 A			
Technology	42	.47 A			
Speaking Used at Complex Level			7, 657	6.7	.0001
Agriculture/Trade	105	.01 B			
Business/Marketing	92	.03 B			
English	149	.13 A			
Home Economics	37	.01 B			
Mathematics	122	.03 B			
Science	79	.04 B			
Social Studies	39	.09 AB			
Technology	42	.06 B			
No Speaking Used			7, 657	2.4	.0192
Agriculture/Trade	105	.42 A			
Business/Marketing	92	.54 A			
English	149	.39 A			
Home Economics	37	.52 A			
Mathematics	122	.42 A			
Science	79	.38 A			
Social Studies	39	.38 A			
Technology	42	.47 A			
Purpose was Application and Transfer			7, 238	1.9	.0642
Agriculture/Trade	44	1.00 A			
Business/Marketing	28	.90 A			
English	65	.84 A			
Home Economics	11	.91 A			
Mathematics	40	.91 A			
Science	25	.97 A			
Social Studies	16	1.00 A			
Technology	17	.93 A			

[a] Number of classes

[b] Means with same letters are not significantly different

Table 5

Analyses of Variance Outcomes for Writing Skills

Nature of Episodes/Type of Class	n[a]	Mean	df	F value	P>F
Writing Used at Simple Level			7, 656	6.8	.0001
Agriculture/Trade	105	.19 B[b]			
Business/Marketing	92	.43 A			
English	149	.34 AB			
Home Economics	37	.37 A			
Mathematics	121	.45 A			
Science	79	.45 A			
Social Studies	39	.39 A			
Technology	42	.21 B			
Writing Used at Complex Level			7, 656	5.4	.0001
Agriculture/Trade	105	.03 B			
Business/Marketing	92	.05 B			
English	149	.16 A			
Home Economics	37	.02 B			
Mathematics	121	.06 B			
Science	79	.06 B			
Social Studies	39	.06 B			
Technology	41	.09 AB			
No Writing Used			7, 656	8.0	.0001
Agriculture/Trade	105	.78 A			
Business/Marketing	91	.52 C			
English	149	.50 C			
Home Economics	37	.62 BC			
Mathematics	121	.49 C			
Science	79	.49 C			
Social Studies	39	.55 BC			
Technology	41	.70 AB			
Purpose was Application and Transfer			7, 219	2.1	.0452
Agriculture/Trade	28	.86 A			
Business/Marketing	40	.91 A			
English	66	.74 A			
Home Economics	11	1.00 A			
Mathematics	38	.89 A			
Science	24	.79 A			
Social Studies	8	1.00 A			
Technology	12	.98 A			

[a] Number of classes

[b] Means with same letters are not significantly different

Educational Environment of Tenth Grade Students: Comparison by Gender. Ethnicity and GPA

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The study focuses on a contemporary educational issue, the integration of vocational and academic education through technology preparation programs as defined by the recent Carl Perkins legislation. Gender, ethnicity and student grade point average are areas of particular interest in this research. The data were identified during the evaluation component of a New York State Perkins funded project in Agricultural Science and Technology. This evaluation research was designed to provide formative assessment that could enhance curriculum development, guidance and career counseling and educational reform during the developmental phases of the state initiative. Related literature provided a theoretical and conceptual base for the study.

According to the literature, home environment is related to students' achievement in school. The home is as a place where students study and receive parental encouragement . Research on the home environment has historically focused on socio economic status as represented by parental education, income level, or occupation (Kellaghan, Sloane, Alvarez and Bloom, 1993, Bloom 1988). These studies have emphasized the affect of socioeconomic status on school learning as represented by student grade point average, teacher ratings or performance on standardized tests.

Parental attitudes and interests also affects school learning. Marjoribanks (1976) and Bloom (1988) found that the perceived role of education has a greater affect on student learning than socio economic class. In other studies, the role of language ability and the use of complex forms of thought and language is associated with academic ability in children (Gordon, 1973; Bernstein, 1975). Factors such as these frequently differs across class and ethnic boundaries.

Similarly, the presence of educational materials such as books, dictionaries, and encyclopedias consistently relates to school interest and achievement (Applebee, Langer and Mullis, 1989, Bloom, 1988; Morrow, 1983). New technologies such as television and computers are also entering households at a rapid pace and have been shown to have varying affects on learning (Ridley-Johnson, Cooper, Chance, 1982; Kellaghan et al, 1993). Patton, Stinard and Routh (1983) examined the study habits of fifth through ninth grade students and determined that television and radios were often used as 'background noise' during study of mathematics in the home environment. Quiet space was necessary for reading comprehension. The availability of "quiet space" is a crucial component of a supportive home environment (Bloom, 1988; Kellaghan et al, 1993). The availability of educational materials and appropriate study environments may differ as a function of ethnic background (Soto, 1989).

Characteristics of the home environment have been categorized by Bloom (1981) as 'academic guidance support" that is crucial to student learning. However, models that describe the relationship of academic support to grade point average, gender and ethnic background of students need to be developed. Investigations of this type can be strengthened by a strong conceptual framework.

Social and cognitive learning theories (Novak, 1977; Ausubel, 1968; Vygotsky, 1962; Bandura, 1986) as well as developmental theories from an ecological perspective such as that of Bronfenbrenner (1979) provide a framework to investigate the role of the home environment in school learning. These theorists share a constructivist perspective with respect to curriculum development which supports and expands traditional theories of experiential education as described by Dewey and contemporary researchers. Knowledge construction is viewed as being a direct result of experience. Learning is therefore related to previous experiences and understandings. Additionally, since learning is related to a variety of academic, social and personal experiences, these theories may help explain the role of the home environment in school learning. In particular, Vygotsky's theories of language development as the primary vehicle for social and cognitive learning supports the role of language ability and home language in school learning. Framing the study in cognitive psychology adds to the richness of the investigation and provides a base for implementing findings and conclusion in a contemporary teaching and learning model

Objectives

The purpose of this study was to develop an understanding of tenth grade student's home educational environment in relationship to gender, ethnicity and grade point average. Findings will be useful to develop an effective educational program that provides equitable learning opportunities for all high school students. The research objectives were to:

1. Determine the home educational environment of tenth grade students as represented by the availability of educational materials including books, computers, dictionaries and encyclopedias as well as the availability of quiet or private study space.

2. Determine the differences by gender, ethnicity and grade point average which exist with respect to the home educational environment.

3. Develop recommendations for curricular assessment and guidance counseling strategies to improve teaching and learning opportunities for a diverse student body.

Methods

Twelve geographically distributed pilot high schools and technical centers were selected as a stratified random sample from thirty eight (38) New York State schools willing to participate in the study. The school selection process was designed to identify schools that were representative of schools within the State in terms of high schools in urban and rural areas, schools with and without agricultural education in the curriculum, and central high schools and technical centers (Boards of Cooperative Educational Services typically referred to as BOCES). The selection panel to identify schools included representation from Deans of Agriculture in two—year colleges, the New York State Rural Schools Program, public school administrators, and the State Department of Education. All schools in the sample had a tenth grade cohort with the exception of one BOCES Center. Since one of the feeder schools to this BOCES was in the project, this technical center was represented in the data set.

The schools were contacted to solicit cooperation, identify school contact persons and to determine the number of students in the tenth grade. Tenth grade students were selected as the sample because they would be the first class to enroll as juniors in a Technology Preparation Program. A packet of instruments was mailed to each contact person along with standardized instructions on how to administer the instrument to students. Surveys were collected after completion, resulting in a complete return rate without the need for a follow-up.

Instrumentation

The researchers developed a Career and Educational Interest instrument to address the research objectives. The instrument consisted of two separate forms: Form 1, Home and School and Form 2, Agriculture and Technology Preparations. The instrument and data collection procedures were field tested in five pilot schools to determine reliability for related subscales following the recommendations of Dillman (1978) and Fowler (1988). A total of one hundred and seventy two students participated in the initial field test. Cronbach's alpha was used to assess subscale reliability. Field test alpha coefficients ranged from .58 to .98. For subscales below .70, questions were modified to achieve a higher reliability coefficient. Additionally, a panel of experts consisting of two and four year college faculty assessed content validity of the instruments. Based on pretest results the questionnaires were revised as necessary.

The revised instruments were submitted to a commercial vendor to convert to opscan format. This provided an easy to follow, self-contained booklet that had a professional appearance. It also transformed the instrument to machine readable form that could be quickly scanned to a data file. The final questionnaire consisted of Likert type scales using a strongly disagree to strongly agree scale and nominal level data.

Data Source

Tenth grade students from each school completed the instrument based on the size of the tenth grade class. In schools with less than 300 students, all tenth grade students completed the instrument. In one larger school, a power of the test calculation was used to identify a representative, random sample. The school contact assigned each student a number to identify the research instruments and to assure respondent anonymity. Similarly, the schools were coded by number. In the majority of schools, the same students completed both forms of the survey. However, two schools experienced difficulty with survey administration procedures. In these schools, a student completed either Form 1 or Form 2 but not both. In each case, questionnaire forms were distributed randomly to the student population and should not bias the results. A total of 927 respondents completed Form 1 and 925 respondents completed Form 2. Sampling procedures with this slight modification provided valid and reliable data for the study.

Data Analysis

Data were analyzed using SPSS/PC. Frequencies were obtained on all data. Statistical comparisons between groups were made by gender, ethnicity and GPA on categorical data using cross tabulations and Pearson's chi-square.

Results

Descriptive statistics were used to analyze the findings. Cross tabs and Pearson's chi-square were used to test for independence at .05 Alpha.

Study Environment of Tenth Grade Students

As shown in Table 1, respondents rated themselves as having a wide variety of educational materials in the home including calculators (98.2%), dictionaries (97.8%), more than 50 books (82.7%), encyclopedia's (79.9%) and an atlas (73.5%). Over forty three percent of households (43.6%) owned a computer.

The majority of students rated themselves as having "a room of their own" (82.3%) and a "quiet room to study" (71.7%). Approximately a third of the students had "a specific place to study" (36.1%).

Table 1: Study Environment of Tenth Grade Students Frequencies and Percentages

	f	%
Calculator	913	98.
Dictionary	908	97.
VCR	896	96.
More than 50 books	767	82.
Room of their own	765	82.
Regularly received magazine	698	75.
Encyclopedia	743	79.
Atlas	681	73.
Quiet room to study	664	71.
Daily newspaper	624	67.1
Computer	404	43.
Specific place to study	335	36.1

Gender

The test for independence of gender with educational opportunities, as shown in Table 2, found that females were more likely to have a calculator, dictionary and more than fifty books available in the home than males. More males rated their household as having a computer than females (p=.01043).

Ethnic Background

Independence of ethnic background with educational materials and opportunities were examined at the .05 alpha level. The availability of a "room of their own", a "regularly received magazine" an "encyclopedia" background. Asians and Hispanics were less likely to have a room of their own, magazines or encyclopedias than whites, blacks or American Indian and Alaskan Natives. Asians and American Indians however, were more likely to have a specific place in which to study than blacks, whites or Hispanics.

Grade Point Average

Cross tabulations and Pearson's chi-square were also used to examine the independence of grade point average to available home educational materials and opportunities. As shown in Table 2, with the exception of a VCR and a daily newspaper, the availability of each item was highly dependent upon grade point average. In the majority of cases, a lower grade point average was associated with less availability of educational tools and opportunities.

Table 2: Study Environment of Tenth Grade Students by Ethnicity and Grade Point Average

Item	Gender	Ethnicity	% in Home GPA	Tracks
Calculator	.00332 F=99.4 M=96.8	--	.01009 A=98.9 B=99.2 C=95.6 D=100 F=100	.00305 R=99.3 L=96.7 U=95.0
Dictionary	.01159 F=99.0 M=96.6	--	.00052 A=93.8 B=99.7 C=76.6 D=98.0 F=100.0	.00000 R=99.8 L=96.3 U=91.0
More than 50 Books	.01009 F=85.7 M=79.3	--	.00001 A=93.8 B=82.2 C=76.6 D=69.4 F=92.3	.00153 R=85.9 L=78.0 U=74.0
Room of their own	--	.00000 AI=90.0 W=86.9 B=80.0 H=59.7 AS=47.1	.02864 A=86.4 B=84.0 C=75.6 D=81.6 F=84.6	--
Regularly received magazines	--	.00000 W=78.7 B=72.5 AI=70.0 H=57.4 AS=41.2	.00023 A=85.2 B=76.4 C=70.0 D=59.2 F=61.5	.00001 R=80.5 L=67.5 U=64.0
Encyclopedia	--	.00047 AI=90.0 W=81.7 B=75.0 H=69.4 AS=52.9	.01076 A=84.1 B=82.5 C=73.8 D=71.4 F=92.3	.01398 R=81.8 L=78.9 U=69.0

Atlas	--	--	.00025 A=80.7 B=77.1 C=64.1 D=67.3 F=69.2	.03441 R=76.3 L=69.3 U=66.7
Quiet room to study	--	--	.00000 A=86.9 B=73.0 C=60.3 D=61.2 F=69.2	.00001 R=75.2 L=70.4 U=51.0
Computer	.01043 M=22.6 F=20.9	--	.00524 A=52.3 B=44.8 C=37.5 D=28.6 F=53.8	.00004 R=49.1 L=33.7 U=34.0
Specific place to study	--	.0045 AS=61.8 AI=60.0 H=41.7 B=40.0 W=33.3	.0136 A=44.9 B=36.4 C=28.7 D=36.7 F=30.8	.0015 R=69.4 L=21.5 U=9.1

Key: Gender: F=female, M=male, Ethnicity: B=Black, W=White, H=Hispanic, AI=American Indian or Alaskan Native, AS=Asian or Pacific Islander, Track: R=Regents, L=Local Diploma, U=Undecided.; Note: Table includes only items for which dependency was identified.

Track

Similar to the results of the dependency of GPA on gender, with the exception of a VCR and a daily newspaper, the availability of each item was dependent upon track. In all cases, students following a regents track were more likely to have the educational material in the household than were students following a local track. Students who were still undecided were least likely to have access to the educational material.

Conclusions and Educational Implications

1. The availability of educational materials and opportunities in the home environment of tenth grade students was generally high ranging from 98.2% of students having a calculator to 36.1% of students having a specific place in the household in which to study. Over two fifths (43.6%) of students owned a computer. Most students, therefore, appear to have sufficient supplies available in the home to facilitate learning.

2. The availability of educational materials and opportunities to learn differed by gender and ethnic background. Hispanic and Asian students in particular appear to have less access to educational supplies. Access to supplies may reflect educational attitudes of parents as well as the socio economic class of the household. Both factors have been shown to affect school learning. Guidance counselors, teachers and administrators should take differential home environments into consideration when preparing and

teaching courses to take into account access to learning opportunities.

3. The availability of educational materials and opportunities to learn were dependent on grade point average and high school track. Students with higher grades and in the regents track were more likely to have access to educational opportunities. This dependency may suggest the importance of the home environment and the need for alternatives to access appropriate educational materials in academic success as measured by GPA.

4. Results suggest an inequity in the home environment dependent upon GPA, ethnic and gender as well as high school track. This situation could have implications for diversity in the classroom and workplace. This situation raises questions about sociological barriers discussed by Nichols and Nelson (1993) and ecological barriers that relate to views of Bronfenbrenner (1979).

5. The conceptual base for the study links previous learning to current learning. Thus, experiences with differential home environments could have implications on school learning, recruitment into higher levels of education and future employment.

6. Parental attitude was not explored in this study. Future research should examine the relationship of parental attitude to the home environment and explore potential causal relationships including barriers to participation, guidance practices, positive and negative consequences of the home environment, student choice, related developmental theory and implications for using a constructivist view of curriculum development.

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Skills Required of Employees With Only a High School Diploma

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There has been a great deal of discussion in recent years about the need to prepare young people for the challenges they will face in a technology-based global economy. To meet this challenge, schools must help students master the necessary reading, writing and math skills required for employment. Students must be confident in their ability to communicate, critically think, and work in group situations. Given these highly-technical times, students must also have an understanding of technological innovations, and issues affecting their lives. In essence, schools must prepare students to live knowledgeably and contribute productively in this complex environment.

Despite calls for an educated workforce, in North Carolina there remains a sizable number of individuals that do not receive post-high school education or training. According to the Statistical Profile of North Carolina Public Schools (North Carolina State Board of Education, 1985), nearly 20 percent of the high school graduates do not pursue further education through community colleges, universities, or the military.

Considering the need for employees' basic skills and the lack of post-high school education being obtained by many in North Carolina, several critical issues were examined. First, how many people are hired with only a high school education by the major manufacturing firms in North Carolina? Second, what are the projected trends of employment? That is, will employers likely continue to hire high school graduates at the current rate, or will openings for high school graduates increase or decrease? Third, and the primary focus of this study, what types of skills do employers require of high school graduates?

Through an examination of these issues, necessary high school competencies can be prioritized, community colleges can better determine recruitment strategies, and employers can identify areas where additional training is needed. Provided in this paper are the results of a study conducted by Volk and Peel (1994) to address questions related to job opportunities available for high school-degreed employees. Also identified and rated in this study were the necessary skills these employees must have in order to be successful. (A graphic representation of the data, as well as a copy of the instrument are available from the authors in the Executive Summary of this study).

The Study

A survey of manufacturers in North Carolina was used to determine basic academic and vocational skills required of employees with only a high school diploma. In designing the instrument, necessary skills required for an educated and employable citizenry were reviewed through the policy and position papers issued by a number of government, manufacturing, and educational organizations. Included in these organizations were the American Society for Training and Development, the National Center for Education and the Economy, the North Carolina

Department of Economic and Community Development, and the U.S. Department of Labor. From the list of competencies identified, an instrument was designed to determine the importance of various academic and vocational skills.

Manufacturers with over 500 employees, identified through the Directory of North Carolina Manufacturing Firms (North Carolina Department of Economic and Community Development 1992) were mailed surveys. Each survey was addressed to the representative identified in the Directory; most often the company president or plant manager. The representatives were asked to rate skills as absolutely required, desired but not required, or not required from a high school graduate in their firm. Company representatives were also given the opportunity to provide additional comments on high school graduation requirements. Approximately one month after the initial mailing, a follow-up mailing was conducted for those not responding to the first mailing. From the 289 firms identified and sent surveys, 129 responded. This represented a 45 percent response rate. For data analysis, the manufacturing firms were categorized by the number of employees at their location and their type of manufacturing operation.

Profile of Survey Respondents

Table 1 shows the sample sizes and respondents by establishment size. Information regarding the range of employee numbers at each particular firm's location was provided in the Directory. These ranges were used to determine employee totals. Using the high and low ranges, it was estimated that between 98,000 and 165,000 North Carolina employees were directly represented in this study. When representatives were asked the number of people the company employs in North Carolina, the total number of employees represented in this study greatly increases. From the responses, it was indicated over 250,000 individuals are employed throughout North Carolina by these firms and were indirectly represented in the study.

Table 1: Respondents by Establishment Size

Number of employees	Number of Firms responding	Percentage of total firms
500-999	91	70.5
1,000-2,4999	28	21.7
2,500+	10	07.8
total	129	

According to the Standard Industrial Classification System (SIC) used in the Directory, 13 broad groups of manufacturers participated in the study. Since the survey was mailed to all manufacturing firms in North Carolina identified in the Directory as employing 500 or more at their particular location, no attempt was made to control for manufacturing type.

Table 2 provides a summary of the manufacturing groups participating in this study. Of the 129 respondents, more than 15 types of manufacturing firms were represented. The textile and apparel group represented nearly a third of all manufacturing firms. Electronic and machinery companies, combined with textile manufacturers represented over 50 percent of the firms responding.

Table 2: Respondents by Manufacturing Type

Manufacturing Type	Number Responding	Percentage of Total
Textile & Apparel	39	30.2
Electronic & Electrical Equipment	17	13.1
Machinery & Computer Equipment	10	7.8
Food	8	6.2
Furniture	8	6.2
Chemical Products	7	5.4
Rubber & Plastic Products	7	5.4
Transportation Equipment	7	5.4
Lumber & Paper	6	4.7
Measuring & Analyzing Instruments	5	3.9
Printing & Publishing	5	3.9
Tobacco	3	2.3
Stone, Clay & Glass Products	3	2.3
Miscellaneous	4	3.1

The Survey of Basic Academic and Vocational Skills requested information from employers concerning the number of current employees and anticipated hirees with only a high school diploma. The purpose of collecting these data was to establish the availability of jobs in manufacturing firms which require only a high school education.

Table 3 provides a profile of the employees hired, according to the manufacturing firm representative. As indicated in Table 3, over 69 percent of the employees from these manufacturing firms are hired with only a high school diploma. The employers also reported there exists a large number of jobs that could be done by high school graduates. According to these firms, nearly three-quarters of the jobs could be done by someone with only a high school diploma.

Table 3: Employee Profiles

Characteristic	Average response
Percentage of people employed with only a high school degree	39%
Percentage of jobs that could be done by someone with only a high school degree	73%
Percentage of people hired in the past year with only a high school degree	72%
	Percentage of total
Future number of employees expected to be hired with only a high school diploma will:	
Increase	13%
Decrease	30%
Remain the same	57%

Table 4: Reading, Writing and Math Skills

Skill statement: High school graduates should have the necessary skills to:	Mean	SD
perform simple mathematical functions (+,-,*,/)	1.90	.35
understand common job-related words	1.89	.34
read the local newspaper	1.73	.51
read instruments such as gauges and meters	1.62	.55
write simple memoranda	1.48	.56
read technical manuals	1.36	.57
estimate time, weight, and speed measurements	1.26	.66
understand elementary statistics	1.16	.58
read blueprints	0.95	.75
perform algebraic equations	0.88	.67
understand geometric principles	0.86	.65
write a technical report	0.85	.64

Table 5: Communication Skills

Skill statement: High school graduates should have the necessary skills to:	Mean	SD
follow procedural instructions	1.91	.31
speak in clear sentences	1.81	.41
listen to formal presentations	1.71	.49
give clear directions	1.71	.49
sketch and dimension an object in multiview	0.45	.62
understand and/or speak another language	0.30	.54

There was a high percentage of high school graduates hired last year by these manufacturing firms. This number compares favorably with the number of jobs that can be done with a high school diploma. Over half the firms felt their percentage of new hirees requiring only a high school diploma will remain unchanged in the future. Only 13 percent indicated an increase, while 30 percent indicated a decrease.

Also requested in the survey were skill levels needed from employees with high school degrees. Statements regarding skills or competencies were generated from a review of current reports on education. These skill statements addressed not only academic concerns; issues regarding personal attitudes and conduct were included as well. Nine categories were used to group the skill statements for the survey. Category headings were generally patterned after an earlier study conducted by Northern Illinois University (1991) which only broadly defined these skill areas. The following pages summarize the results.

Reading, Writing and Math Skills

Table 4 shows the rating of reading, writing and math skills for high school graduates. Employers agreed that basic math and reading skills were absolutely required for high school graduates to successfully enter the workforce. Graduates should be able to perform the simple mathematical functions of addition, subtraction, multiplication, and division. Almost equally important was an understanding of common job-related words. Generally, high school graduates who are seeking employment need to be proficient in reading at a level comparable to reading the local newspaper. Seventy-six percent of those surveyed absolutely require this level of reading to be successful on the job. There is less agreement among employers concerning required mastery level of skills beyond basic reading and math. For instance, few employers require high school-degreed employees to understand algebra. While half of the respondents desire this skill, less than 20 percent require it. Understanding principles of geometry was, in fact, as important to employers as algebra. An interesting finding from this study was that more employers desired skills in elementary statistics than either algebra or geometry. Writing skills were viewed as being less important than the reading and math, with employers generally desiring these skills, but not requiring them.

Communication Skills

A great deal of consensus was found among employers related to communication skills needed for high school graduates. As shown in Table 5, there were few employers who did not require graduates to be able to give or follow clear directions. All but two survey respondents required or desired these general listening and speaking skills. The expectation is that high school graduates who go directly to work, must be able to follow procedural instructions and speak clearly. Listening skills and the skills necessary to give clear directions were viewed as being equally important. Over 70 percent of the respondents considered these skills to be absolutely required of high school graduates. While communication skills encompass more than just listening and speaking, there was little indication that employers required such skills as representing information graphically. Less than seven percent absolutely required their employees have the ability to sketch objects in multiview. While most employers did not require high school graduates to speak or understand another language, one-fourth of the employers required or desired these skills.

Critical Thinking Skills

Critical thinking skills were generally viewed as being absolutely required or desired by respondents. As shown in Table 6, three of the four statements were rated on the average above 1.58; indicating their importance. Generally, employers desired problem-solvers and independent thinkers. The remaining area of critical thinking, the ability to formulate a hypothesis, received less support.

Table 6: Critical Thinking Skills

Skill statement	Mean	SD
High school graduates should have the necessary skills to:		
understand problem-solving processes	1.74	.44
troubleshoot problems	1.68	.48
make decisions independently	1.58	.51
formulate a hypothesis	1.05	.73

Every employer surveyed required or desired that high school graduate employees demonstrate the ability to solve problems. This item was one of only two statements on the survey that every employer supported to at least some degree. Of the 129 respondents, 96 required and 33 desired this skill. Also important for high school graduates is the ability to troubleshoot problems and make decisions on their own. Over half of the survey respondents absolutely required that employees have these skills. Only one response in each of these areas did not at least desire this skill.

Group Interaction Skills

As Table 7 indicates, all eight skill statements listed in the Group Interaction Skills category received strong support from employers. In fact, of the nine skill categories on the survey, high school graduates needing group interaction skills was marked the highest. With the exception of only three areas: recognizing cultural diversity, recognizing equality of sexes, and participating in group discussions, more than 100 of the 129 respondents indicated all of these skills were absolutely required of high school graduates.

Respondents especially want graduates who can work well with supervisors, team members, and colleagues. All three of these statements were rated on the average above 1.90; indicating how extremely important it is for high school graduates to possess the ability to get along with others in the workplace. High school graduates having the ability to work as team members was absolutely required by 94 percent of employers. This skill goes beyond having to work well with supervisors and colleagues. Workers must be able to work together as a team in order to solve problems in the organizational environment. Aligned closely with working well with others and participating as a team member, is respecting others' opinions. This statement received a 1.85 average rating; indicating its importance. Two other areas, while receiving slightly lower ratings, were still viewed as being very important. These skills, seemingly related, are the willingness to ask questions and participate in group discussions. Finally, while there was some disagreement of the importance to recognize cultural and ethnic diversity and the equality of the sexes, both areas received strong endorsements.

Table 7: Group Interaction Skills

Skill statement High school graduates should have the necessary skills to:	Mean	SD
work well with supervisors	1.95	.25
work as a member of a team	1.94	.27
work well with colleagues	1.93	.28
respect others' opinions	1.85	.38
be willing to ask questions	1.81	.41
participate in group discussions	1.74	.47
recognize equality of the sexes	1.72	.50
recognize cultural and ethnic diversity	1.64	.53

Personal Development Skills

There was again a great deal of consensus among employers on the need for high school graduates to enter the workforce with well-defined personal development skills. Table 8 details the relative strength of this category.

Table 8: Personal Development Skills

Skill statement High school graduates should have the necessary skills to:	Mean	SD
exhibit self-esteem	1.71	.46
establish personal goals	1.67	.51
work toward advancement	1.64	.50
recognize career options	1.57	.51
desire further education or training	1.57	.51

High school graduates should exhibit self-esteem to be successful in today's manufacturing world. As was the case for graduates having basic problem-solving skills under the Critical Thinking Skills category, every employer required or desired that employees exhibit self esteem. Respondents want high school graduates who set goals and work towards advancement. Employers also expected high school graduates to recognize career options. Finally, skills related to further education and training were considered important. Over 98 percent of the employees absolutely required or desired all five skills in this category. Emphasizing the importance of this category, it is noted that the category of Personal Development Skills was rated as the third most-important category, when average group responses were compared (see Table 13 for comparisons of categories).

Computer Skills

Computer skills were the least important category of skills required of high school graduates. This skill category ranked the lowest of all nine categories. Table 9 shows the ratings for items in this category.

Table 9: Computer Skills

Skill statement High school graduates should have the necessary skills to:	Mean	SD
operate a computer keyboard	1.42	.58
operate word processing software	0.95	.56
understand DOS commands	0.79	.63
operate spreadsheet software	0.78	.59
operate database software	0.72	.57
operate desktop publishing software	0.60	.59
operate computer-aided drafting software	0.50	.59

As Table 9 indicates, the only skill receiving a high endorsement was the ability to operate a computer keyboard. Even in this case, only 46 percent of respondents absolutely required this skill of its high school-graduated employees. Understanding software for word processing was rarely required but often desired. Only 13 percent of respondents absolutely required, while 68 percent desired this skill. Nineteen percent did not require this skill at all. All other skills listed in this category were rarely absolutely required. With the exception of keyboarding operations and word processing, no computer skill listed was absolutely required by more than 15 of the 129 respondents (12 percent). Equally as important, over 30 percent did not require any of these five skills for high school graduates to enter their manufacturing firms. For instance, even the skill and ability to understand DOS commands was not required by 33 percent of employers. Computer-aided drafting skills were not required by 54 percent.

Technological System Skills

Employers responding to this survey were mixed on the importance of high school graduates needing to understand technology systems. Table 10 details the results of this category. While more than 50 percent absolutely required high school-degreed employees to have the ability to select proper tools or equipment for a given task and follow written directions to assemble equipment, less than 30 percent required graduates to calibrate instrumentation or know how technological systems operate.

Table 10: Technological System Skills

Skill statement High school graduates should have the necessary skills to:	Mean	SD
select the proper tools or equipment for a task	1.73	.51
assemble equipment following written directions	1.48	.63
know how technological systems operate (e.g. communications, manufacturing)	1.16	.65
calibrate instrumentation	1.00	.73

As indicated in Table 10, the skills necessary to select the proper tools or equipment received an average rating of 1.73; suggesting its importance. Following written directions, closely related to the skills of following procedural instruction in the

Communication Skills category, received a rather strong endorsement. Knowing how technological systems operate with such features as the inputs, processes, and outputs of manufacturing and communication technology, was absolutely required by only 30 percent of the respondents. However, it was desired by 55 percent. Calibrating instrumentation was the only skill listed on the survey that received a 1.00 rating; indicating the neutrality of employers desiring this skill.

Leadership Skills

Table 11 shows the ratings for leadership skills. Most employers required or desired graduates to have leadership abilities. There was a great deal of consensus among respondents that graduates should enter the workforce with general skills and abilities to lead others. Regardless of whether high school graduates begin in leadership positions, demonstrating leadership skills was viewed as important to employers.

Table 11: Leadership Skills

Skill statement High school graduates should have the necessary skills to:	Mean	SD
negotiate and resolve conflicts	1.53	.57
improve organizational effectiveness	1.50	.59
demonstrate leadership qualities	1.39	.55
motivate others	1.28	.60

The relative importance of individuals being able to negotiate and resolve conflicts was noted. Over 96 percent thought this skill was absolutely required or desired. This skill compared favorably with the skills listed under the Group Interaction Skills category. While over half of those surveyed absolutely required graduates to be able to negotiate and resolve conflicts, it was less important for high school graduates to be able to motivate others. Only 36 percent absolutely required this skill. Improving organizational effectiveness was considered a valuable skill for high school-graduated employees to possess. Over 50 percent of respondents absolutely required that degreed employees, participate such productivity-related matters. Generally, employers are looking for those individuals who have the skills necessary to lead the organization. This skill was desired by 97 percent of respondents.

Employability Skills

Employability skills were the second-highest rated skill category in this survey. With the exception of participating in community and civic activities, there was general agreement on the desirability of all skills in this area. A further indication of the importance of the particular skills in this category, was that maintaining quality standards and regular work habits were the two skills from throughout the entire survey that were most often rated by respondents as being absolutely required. Of the 129 employers, 125 marked these areas as absolutely required of high school graduates. Table 12 shows the results for this skill area.

Table 12: Employability Skills

Skill statement High school graduates should have the necessary skills to:	Mean	SD
maintain quality standards	1.96	.23
maintain regular work habits	1.96	.23
demonstrate punctuality	1.95	.25
take pride in one's work	1.92	.30
practice a healthy lifestyle	1.76	.45
have knowledge of the company	1.71	.47
participate in community/civic activities	1.25	.56

Employers want high school graduates who are punctual and take pride in their work. Over 93 percent (120 of the 129 respondents) absolutely required these skills. Of these four top-rated items, only one respondent per item did not support the skill as being required or desired. For example, of the 129 respondents, 124 absolutely required, four desired, and one did not require that employees demonstrate punctuality. While less important, it was expected that high school graduates practice a healthy lifestyle and have knowledge of the company. Again, many employers (over 70 percent) absolutely required that graduates demonstrate these skills. The least important area required in this category was for employees to participate in community and civic activities. Still, over 93 percent at least desired this participation.

Group Comparisons

A comparison was made between the nine categories of skills to gauge their relative importance. Using responses to skill statements in each area, the average for the categories was determined. Table 13 shows the results of the comparison.

Table 13: Group Comparisons

Skill category	Mean	SD
Group interaction skills	1.83	.41
Employability skills	1.79	.45
Personal development skills	1.63	.50
Critical thinking skills	1.51	.61
Leadership skills	1.42	.58
Technological system skills	1.34	.70
Reading, writing and math skills	1.33	.69
Communications skills	1.31	.83
Computer skills	0 82	.65

Group Interaction Skills was the most important skill area high school-graduated employees must have. This category included such skills as working well with colleagues and supervisors, working as a team member, and respecting others' opinions. The second most important skill area identified by employers was Employability Skills. High school graduates should have skills necessary to maintain quality standards, maintain regular work habits, and take pride in their work. Personal Development Skills was the third most important skill area. This category included exhibiting self-esteem, establishing personal goals, and desiring further education. Basic Reading, Writing, and Math Skills were viewed as being less important to employers than most other skill categories. These basic academic skills ranked seventh of the nine categories examined. It was interesting to note that skill statements relating to statistics, algebra, and geometry were rated below 1.00 for this category.

Communications Skills rank around third, when the need for foreign language and ability to sketch objects in multi-view are not considered. This category was found to have the greatest variance. Computer Skills were indicated as being less important than all others. Although there was a need for basic keyboarding skills, little indication was given for other areas such as spreadsheets, databases, and computer-aided drafting. A general observation made from these comparisons was that skills relating to affective domains; that is, the attitudes, personalities, and emotions of the employees were rated generally higher than those categories dealing with technical or academic concerns.

Conclusion

Documents such as America's Choice, High Skills or Low Wages! National Center for Education and the Economy, 1991), The SCANS Report (The Secretary's Commission on Achieving Necessary Skills 1991), and America and the New Economy (Carnevale,1991) have identified educational standards and workplace skills. These documents described in great detail the state of the American economy and the changes being made in the workforce. North Carolina's workforce is a reflection of the type and amount of education its citizens receive. With nearly 20 percent of high school graduates not continuing further education through community colleges, universities, or military service, the skills they receive from their terminal program is of paramount importance. This point, coupled with the over 12 percent high school dropout rate, places even greater significance on the high school experience.

Employers on the other hand, are left with a pool of individuals who may, or may not have the necessary skills for the types of positions available. This study was designed to clarify the necessary skills employers desired of high school graduates. The focus group for the study was manufacturing firms in North Carolina employing more than 500 individuals at their particular locations. Results indicated that high school-graduated employees will remain a commodity in the future. That is, most firms will remain constant or increase the number of jobs requiring a high school diploma. Further results indicate that these graduates may need different skills from what is currently being suggested.

What has been traditionally perceived as the skills necessary for high school graduates to be successful in the workplace was not born out. Reading, writing and math skills, while important, were not given the priority that would be expected. Conversely, group interaction skills received an overwhelming endorsement. Generally, the affective domain was emphasized by employers. Educators, policy makers, and the public are therefore recommended to consider these findings when setting educational priorities, procedures and improvement strategies for the future.

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INTEGRATION OF MATHEMATICS INTO TECHNOLOGY EDUCATION AS PERCEIVED BY TECHNOLOGY EDUCATION TEACHERS

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Introduction

Integration of academic and vocational skills has all the signs of a new movement in vocational education. Such efforts were supported by policy makers, business sectors, vocational educators, and cognitive scientists for various reasons (Grubb, Davis, Lum, Plihal, & Morgaine, 1991). It was also the benchmark for the Carl D. Perkins Vocational and Applied Technology Act of 1990.

The potential advantages to integrate academic and vocational skills in schools included: (a) richer, more coherent curricula (Rosenstock, 1991); (b) more activity-based pedagogy; (c) more teacher collaboration and coordination; (d) more attention to school transition (Bodilly, 1992): and (e) increase in student retention (Crain & Hebner, 1992). A major study by Grubb, Davis, Lum, Plihal, & Morgaine (1991) characterized eight models of the integration.

Research findings suggested that the successful integration of academic and vocational education was affected by many variables. Owens (1988) identified 11 variables that could substantially influence such integration process, including (a) cooperation between teachers, parents and administrators; (b) administrative support; (c) time for meetings; (d) threat of change; (e) extra work load; (f) feelings of isolation; (~) stepping out of one's discipline; (h) teacher's attitude; (i) graduation requirements; (j) staff development; (k) certification of instructors. McNelly, Thomas, Mann, and Petty (1991) found that the major barriers for academic and vocational integration were: (a) the inadequate funding; (b) lack of cooperation; (c) graduation requirements; (d) lack of time; (e) guidance consolers; (f) poor vocational image, etc.. Other studies by Crain and Hebner (1992) and Rosenstock (1991) concurred similar findings.

As one of the vocational education discipline areas, technology education requires students to understand basic mathematical principles (Barbato, 1991). Goetsch and Nelson (1986) wrote that "a knowledge of the fundamentals of algebra, geometry, and trigonometry, as they relate to drafting applications, is essentials" to drafting professionals. However, no empirical studies were reported in the area of integration of technology education and mathematics.

Goals and Objectives

This study is intended to survey the perceptions of technology education teachers on the integration of mathematics into technology education. Specifically, there were three objectives of this study:

1. to determine the extent to which math was integrated into technology education;

2. to describe the school climate in which the integration took place;

3. to identify the variables which significantly related to the teacher's efforts of integrating mathematics into technology education.

Background

This study was conducted in the state of Delaware. As this study was conducted in the 1993, dozens of schools in- Delaware offered technology education programs, including all the five vocational technical schools and many comprehensive secondary schools. As a member state of the Southern Regional Education Board on Vocational Education, Delaware has a high priority to restructure its vocational education programs. In 1986, the Governor's Task Force on Vocational Education had concluded that academic competency could be carried out through vocational courses. The Task Force pointed out that:

> A modest attempt was made at this a few years ago in Delaware, and failed. Teachers on both sides had trouble with it. We recommend that the idea be tried again, with teachers given more incentives to make it work, and with the provision that performance standards be kept high. (p. 27)

Many innovative appro-aches of curriculum and instruction were being experi-mented in many schools, especially in the vocational technical schools. Some of the examples included: (a) student graduation projects, which encouraged students to creatively utilize their knowledge and skills in various vocational and academic subjects; (b) vocational clusters, which broke down the traditional subject boundaries and forced both vocational and academic teachers to work together; (c) cross field teaching, which inspired vocational and academic teachers to learn from each other; and (d) extended teaching blocks, in which vocational classes were taught uninterrupted for several hours. Technology education teachers have actively participated in these reform efforts.

Significance of the Study

This study should enhance the understanding of the integration process of academic and vocational education. Policy makers could set relevant guidelines to assist vocational educators in their approaches to the integration. It was also the fast empirical feedback to the state of Delaware on its recent integration efforts.

Research Methodology

Sample Selection

The sample of the study consisted of all (N=122) technology education teachers who taught 6th through 12th grade in public schools in the sate of Delaware. The names and mailing addresses of these teachers were obtained with the assistance of the Delaware Department of Public Instruction.

Instrument Development

A survey instrument was developed by the researchers, which had two parts (see appendices A). Part I sought information on the demographic data of the respondents; Part II consisted of 25 questions with 5-point Likert scales, which sought the perceptions of the respondents regarding the integration. The development for the Part II took considerations of the study results reported by previous researchers (Crain & Hebner, 1992; Grubb, 1990; Owens, 1988; Rosenstock, 1991).

A field test was conducted to assure the validity and reliability of this instrument. A group of ten teachers in various vocational and academic fields were chosen for this purpose. As a result of the field test, the instrument was revised and finalized.

Data Collection and Analysis

The survey instrument was mailed to the teachers along with a cover letter from the researchers stating the purpose of the study. A self addressed, stamped envelope was also included. Anonymity of the respondents was assured by not requesting names when the survey was returned. fifteen days after the initial mailing, a second mail was sent to the non- respondents.

Descriptive and inferential statistical analyses were conducted on the data collected. An ~ level of .05 was used in the inferential statistical analyses.

Results and Discussions

A total of 65 technology education teachers (52.2%) responded after the two mailings. The respondents had an average age of 41 (SD=10.40) and an average teaching experience of 16 years (SD=9.97). The majority of them were male (n=60, or 92.3%) and white (a=57, 87.7%). About 92.3% (a=60) of them worked in comprehensive schools, while the remaining 7.7% (n=5) worked in vocational technical schools. Moreover, the respondents varied greatly in their background of mathematics, ranging from having 0 to 30 credit hours in undergraduate work (M=7.67, SD=6.50). About 72.3% (n=47) of them had no graduate math credits at all.

Objective 1: to determine the extent to which math was integrated into technology education

The first question in Part II of the instrument was designed to gather information on this objective. Based on responses of the technology education teachers, this study found that 54.69% (n=35) of the teachers responded either "always" or "often" attempted to integrate mathe-matics into their technology education courses; About 42.19% (a=27) either "sometimes" or "seldom" attempted to integrate; only 3% (n=2) reported "never" tried to integrate (see Table 1).

This result indicated that more than half of the technology education teachers in Delaware did integrate mathematics into their classes on a regular basis. With few exceptions, the technology education teachers have not only been aware of but adopted the approach of integration.

Objective 2: to describe the school climate in which the integration took place

There were 11 questions in Part II of the instrument which sought information on this objective. The perception of the respondents on these variables were reported in Table 2. More than half of the respondents (a=37, or 56.92%) believed that current course scheduling either "always" or "often" restricted the course enrollment of technology educa-tion classes. Moreover, about half (a=33, or 50.77%) of them felt that planning time was "always" or "often" inadequate. specifically, 60.32% (a=38) of the sample reported that time was usually not allocated for inter-departmental meetings to develop the basic skills in their courses. On the other hand, the majority of the teachers felt that both their school principals (a=35, or 53.85%) and curriculum directors (a=39, or 61.90%) were "always" or "often" supportive of technology education programs. Furthermore, about 87.30% (a=55) of the teachers reported that counselors "always" or "often" directed students with basic skill deficiencies toward their courses. However, most of the technology education teachers (a=49, or 77.78%) did not receive instructional assistance for students with special needs. Finally, funding for technology education program development was rarely adequate as perceived by most of the teachers (a=35, 53.85%).

Objective 3: To identify the variables which significantly related to the teacher's efforts of integrating mathematics into technology education

The Spearman rank-order correlation analysis was used to determine which were the variables significantly related to the efforts the teachers made on integration. A list of variables were analyzed, and the results were shown on Table 3. Based on this information, the study identified 10 variables which were significantly (∂=.05) related to the teachers' efforts of integration:

(a) interests in integration (p=.645);
(b) reservation for stepping out of the field (p=-.496);
(c) increase in work loads (p=-.434);
(d) obligation to students (p=.378);
(e) discontent with teacher reduction (p=.346);
(f) positive feedback from students (p=.294);
(g) concern for special needs (p=2.73);
(h) concern for scheduling conflict (p=.260);
(i) concern for students' mathematics skills (p=.258);
(j) support received for in-service training (p=.253).

Most of the above variables were associated with the overall attitudes of the teachers toward integration, students, and their profession. A teacher with strong obligations to the student and their profession tended to be more likely to practice the integration. Practical issues such as work loads and support for in-service training were also very important factors related to the integration approach.

The identified variables overlapped somewhat to these reported in research literature, such as teacher's attitudes, work loads, feeling about stepping out of the field, and staff development. However, it was surprised to find that support from the administration was not a significant variable relating to the teachers integration efforts. Probably, it largely depended on the teacher's own initiatives to decide their individual approaches to teaching technology education courses. Also, the technology teacher's perceptions on the graduation requirements and program funding were not related to their integration efforts. One explanation might be that these were global factors that have only indirect impact on the daily teaching of the technology education teachers.

Conclusions

Integration of mathematics into technology education was widely used among the technology education teachers in Delaware. There was a considerable support from the school administration to integration. However, a systematic restructuring in course scheduling was needed in order to satisfy the new environment of integration. Integrated approach to teaching largely relied on the initiatives of individual teachers. In order to encourage further adoption of this approach, efforts should be made to increase the teachers' recognition of its potential values. In-service teacher education can be a viable means to help the teachers to improve their teaching competencies.

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Table 1.
The extent to which mathematics was integrated into technology education

	Always	Often	Sometimes	Seldom	Never
Frequency	14	21	20	7	2
Percentage	21.88	32.81	31.25	10.94	3.13

n=64, there was one missing case

Table 2.
Responses to questions related to the school climate

Variable	Question #	Median	Mean	SD
Academic Requirement	2	3	3.23	1.04
Course Scheduling	3	3.66	1.16	
Planning Time	4	2	2.57	1.15
Support from Principals	7	4	3.68	1.11
Support from Curriculum Directors	8	4	3.7	1.04
Teachers Reduction	9	3	3.22	1.35
Students with Skill Deficiencies	10	4	3.87	1.17
Time for Inter-department Meetings	11	2	2.14	1.12
Assistance for Special Needs	12	1	1.84	1.19
Program Funding	23	2	2.25	1.12
Support for In-service Training	24	3	3.16	1.14

Table 3.
Correlation between the possible variables and the teachers' efforts on integration

Variable	Question #	Correlation	p Value
Academic Requirement	2	.095	.457
Course Scheduling	3	.219	.082
Planning Time	4	-.024	.853
Concern for Scheduling Conflicts	5	.260	.038*
Technology Course Content	6	-.238	.060
Support from Principles	7	-.089	.486
Support from Curriculum Directors	8	-.102	.430
Discontent with Teacher Reduction	9	.346	.006*
Students with Skill Deficiencies	10	.154	.232
Time for Inter-department Meetings	11	.216	.092
Assistance for Special Needs	12	.038	.769
Reservations for Stepping out	13	-.496	.000*
Interests in Integration	14	.645	.00;0*
Increase in Work Load	15	- 434	.000*
Enrollment of Special Needs	16	.273	.030*
Success of Special Needs	17	-.043	.739
Identification of Specific Math Skills	18	226	.072
Concern for Students' Math Skills	19	.258	.039*
Positive Feedback from Students	20	294	021*
Obligation to Students	21	.387	.002*
Calculator Use	22	.151	.239
Program Funding	23	.089	.494
Support Received for In-service Training	24	.253	.045*
Training Received for Integration	25	.156	.225

n=65
* Significant at .05 level

Appendices A

SURVEY QUESTIONNAIRE FOR THE INTEGRATION OF MATHEMATICS INTO TECHNOLOGY EDUCATION

Part I

Please respond to the following questions:

1. Your Gender: Female____Male____

2. Your Age:______

3. Your Race:_____

4. Years of your teaching experience (including this year):_____

5. Your highest educational level: _____

6. Number of undergraduate credits earned in mathematics:______

7. Number of graduate credits earned in mathematics: ______

8. Number of in-service credits earned in mathematics:_____

9. Certification title (s):________________________________

10. Do you have any experience in working in an industry that is related to your teaching position?

Yes_____ No_____

If YES, years of experience:_____

Type of Work:____

11. Type of your school: Comprehensive____ Vocational_____

12. Size of your school (full time student enrollment):_____

13. Grade level that you are presently teaching this year:_____

Part II Please circle your answer for the following questions based on the scale below:
5 =Always 4=Often 3 =Sometimes 2 =Seldom 1 =Never

1.	I attempted to teach mathematical activities in my technology classes	5	4	3	2	1
2.	An increase in academic requirements results in decreasing technology education course enrollment	5	4	3	2	1
3.	Current course scheduling restricts technology education course enrollment	5	4	3	2	1
4.	Planning time is adequate for technology education courses	5	4	3	2	1
5.	Scheduling conflicts exist between academic and technology education classes in my school	5	4	3	2	1
6.	Technology course content does not allow me to integrate mathematical activities	5	4	3	2	1
7.	My principal is supportive of technology education programs	5	4	3	2	1
8.	My curriculum director is supportive of my choice for the technology education course content	5	4	3	2	1
9.	Teacher reduction affects technology education program at my school	5	4	3	2	1
10.	Counselors direct students with basic skill deficiencies toward my course	5	4	3	2	1
11.	Time is allocated for inter-departmental meetings for the development of basic skill activities in non-academic courses	5	4	3	2	1
12.	I receive instructional assistance for students with special needs	5	4	3	2	1
13.	I have reservations in integrating mathematics into technology education because it is not my instructional area	5	4	3	2	1
14.	I am interested in integrating mathematics into technology education courses	5	4	3	2	1
15.	Increase in work load hinders my efforts to integrate mathematics into technology education	5	4	3	2	1
16.	Students with special needs enroll in my technology education courses	5	4	3	2	1
17.	Special needs students satisfactorily pass my technology education courses	5	4	3	2	1
18.	I identify specific mathematical skills that I plan to teach in my tech~ology education for the year	5	4	3	2	1
19.	I test for specific mathematical skill development after instruction	5	4	3	2	1
20.	Students' mathematical skills improve as a result of taking my technology education courses	5	4	3	2	1
21.	I feel responsible for helping students to strengthen their basic skills	5	4	3	2	1
22.	I allow students to use calculators to solve mathematical problems in my class	5	4	3	2	1
23.	Funding for technology education program development in my school is adequate	5	4	3	2	1
24.	I receive adequate support (reimbursement) for in-service training from the school district	5	4	3	2	1
25.	I attend in-service workshops that focus on the integration of mathematics into technology education	5	4	3	2	1